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Simulation Analysis of Inspections of International Travelers at Los Angeles International Airport for US-VISIT

T. Edmunds, P. Sholl, Y. Yao, J. Gansemer, E. Cantwell, D. Prosnitz, P. Rosenberg, G. Norton

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Simulation Analysis of Inspections of International Travelers at Los Angeles International Airport for US-VISIT*

Thomas Edmunds, Patricia Sholl, Yiming Yao,
James Gansemer, Elizabeth Cantwell, and Donald Prosnitz
Lawrence Livermore National Laboratory

Paul Rosenberg and Glenn Norton
Department of Homeland Security
Bureau of Immigration and Customs Enforcement

February 4, 2004

*

Executive Summary

The United States Visitor and Immigrant Status Indicator Technology Program (US-VISIT) will deploy biometric and other systems to identify and track foreign nationals entering and exiting the U.S. Evaluation of the large number of possible policy options and technical configurations for implementation of US-VISIT requires validated system analyses with appropriate tools that can address the requirements of this new program and its processes. Early identification of performance issues and capability gaps will prove critical to the success of the program.

The objectives of the US-VISIT Project at Lawrence Livermore National Laboratory (LLNL)/Homeland Security Organization are to develop and/or utilize tools to acquire and manage the data needed to provide these analyses, to model experimental reengineered processes or technical designs, and to support data analysis, policy determinations, system architecture and/or planning ongoing elsewhere. This report describes our modeling efforts to estimate the impacts of US-VISIT in terms of traveler wait times and queue lengths. Our model uses data from the Los Angeles International Airport (LAX).

Currently, there is no available dataset that indicates how long a traveler waits in a queue to be inspected. However, the Interagency Border Inspection System (IBIS) and Port of Entry Office Management System (POMS) data together provide the basis for modeling the wait time. This study is unique in that it uses and analyzes data only recently available from IBIS to provide more accurate input for the simulation model and a better characterization of the current process than previously possible.

Class-of-admission and primary inspection confirmation time data from IBIS, in conjunction with flight arrival time and inspector availability data from POMS drive simulations customized for evaluation of alternative implementations of US-VISIT and Visa Waiver Program (VWP) biometrics-enabled passport. Average traveler wait time and queue lengths prior to US VISIT implementation that are predicted by the simulation model have been validated against LAX POMS and IBIS data from June 2003. These simulation analyses can assist decision makers in identifying system performance issues and capability gaps. For example, a scenario where all VWP passengers are inspected under the current US-VISIT process is analyzed in this report.

A summary of results is given in the table below.

	Scenario	**Primary queue average wait time (min.)**	**Change in average wait time (min.)**	**Primary queue maximum length (# people)78**	**Change in queue length**
0	Base Case ("as-is")	30.3 +/-4.6	-	1190+/-94	-
1	US-VISIT (NIV prints & photo)	43.2+/-5.4	+12.9	1374+/-108	+184
2	VWP Photo	33.8+/-4.6	+3.5	1250+/-101	+60
3	NIV prints, photo + VWP photo	46.4+/-5.0	+16.1	1424+/-108	+234
4	NIV holders and VWP Travelers (prints and photo)	51.3+/-4.5	+21.0	1521+/-108	+334

0	No Biometric acquired
1	10 seconds required to acquire prints (increase in overall inspection time) 5 seconds required to acquire photo (increase in overall inspection time) 100% of NIVs are enrolled prior to arrival 5 seconds computer and communication time required to check prints (done in parallel with interview) No automated face recognition technology Simulation time 00:00 hours (EST) June 25 through 03:00 (EST) hours June 26
2	5 seconds additional time required to take live photo at primary inspection 10 seconds required to verify photo (1-to-1) and check against facial watchlist 100% of the VWP passengers are in possession of an accredited biometric encoded passport
3	NIV's processed according to Scenario 1 VWP's processes according to Scenario2
4	NIV and VWP common assumptions 1) 15 seconds required to acquire prints and capture photo 2) Simulation time 00:00 hours (EST) June 25 through 03:00 (EST) hours June 26 NIV assumptions 1) 100% of NIVs are enrolled prior to arrival 2) 5 seconds computer time required for 1-to-1 check prints VWP holder assumptions 1) 0% of VWPs are enrolled prior to arrival 2) 8 seconds computer time required for 1-to-n check printsz

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1.0 Introduction

The objectives of the United States Visitor and Immigrant Status Indicator Technology Program (*US-VISIT*[1]) are to facilitate travel, secure our nation, and combat terrorism by improving the processes, policies, and systems utilized to collect and report information on foreign nationals who apply for visas, attempt to enter the country at ports of entry (*POE*), request benefits such as change of status or adjustment of status, and/or depart the United States. In addition, the US-VISIT Program must facilitate legitimate trade and respect personal privacy.

Early identification of performance issues and capability gaps will prove critical to the success of this program. Evaluation of the large number of possible policy options and technical configurations for implementation of US-VISIT requires validated system analyses with appropriate tools that can address the unique requirements of this new program and its processes. The goals of the US-VISIT Project at Lawrence Livermore National Laboratory (LLNL)/Homeland Security Organization are to develop and/or utilize tools to acquire and manage the data needed to provide these analyses, to model experimental reengineered processes or technical designs, and to support data analysis, policy determinations, system architecture and/or planning ongoing elsewhere.

This report describes our modeling efforts and a specific study of international arrivals at Los Angeles International Airport – Tom Bradley International Terminal (*LAX-TBIT*). Since LAX is a multiple inspectional facility, we limited our modeling and reporting only to the TBIT terminal. TBIT was selected as it the largest of the inspectional facilities and accounts for two thirds of the total LAX arrivals during the month. *Class-of-admission* (*COA*) and *primary inspection confirmation time* data from the Interagency Border Inspection System (*IBIS*), in conjunction with *flight arrival time* and inspector availability data from the Port of Entry Office Management System (*POMS*), drive simulations customized for evaluation of alternative implementations in support of US-VISIT and Visa Waiver Program (*VWP*) biometrics-enabled passport programs.

This study is unique in that it uses and analyzes data only recently available from IBIS to provide more accurate input for the simulation model and a better characterization of the current process than previously possible. The report and model are designed to predict changes to *primary queue length* and *wait time* as a measure of system performance due to changes in inspection processes. Average traveler wait time and end-of-day *primary queue* size prior to US-VISIT implementation that are predicted by the simulation model have been validated against LAX POMS and IBIS data from June 2003. To estimate the impacts of the US-VISIT Program, we run a simulation model for a 24-hour period at TBIT, introduce additional requirements such as the collection of biometrics, and compute changes in performance metrics such as wait time and *primary queue length* for various implementation *scenarios*. Analysis of LAX-TBIT data was made more complex because the POE was in a transition period when legacy Customs inspectors were being trained on the job to work the primary line, an older version *class-of-admission* screen was utilized at the POE, and they had not yet installed the now upgraded communication infrastructure.

[1] All italicized terms are defined in Appendix F.

2.0 Data Sources

2.1 IBIS database

The primary data source for the analysis is the IBIS database, which contains records of all name queries performed at the POEs. The US Customs and Border Protection Bureau (CBP), Office of Information Technology staff in Newington, VA, provided IBIS data for the month of June 2003.

The use of actual traveler records from IBIS is unique to this study as other current simulation models use estimates of traveler processing times (in addition to time and motion studies from subject matter experts at the POE for the Workforce Analysis Model (WAM))[2]. Sample data records extracted from the database that were used in this study are shown in Appendix A. The IBIS fields extracted from the traveler records for this study are shown in Table 2.1.

Table 2-1 - IBIS Data Fields

1. Confirmation date
2. Confirmation time
3. Confirmation terminal
4. Site ID
5. IATA Airport Code for Site ID
6. INS Port code for Site ID
7. Estimated arrival date
8. Secondary Referral Code
9. Lookout Type Code
10. Airline Carrier Code
11. Flight Number
12. Departure Airport Code
13. Gender Code
14. Date of birth
15. Document Type Code
16. Document Country Code
17. Visa Class of Entry Code
18. Admit Until Date
19. Length of Stay (days)

IBIS data fields one through four specify when and where the traveler is confirmed at *primary inspection*. Fields seven, ten and eleven uniquely identify the flight. Field seventeen contains the class of admission. The other fields, such as gender and date of birth, were extracted for use within the model to show how those factors may be used to influence policy decisions and/or process and wait times, however, these analyses were not included in our simulations. The IBIS data does not include the *flight arrival (block) time* or inspector availability, so that a traveler's history at the POE cannot be traced from the IBIS data alone.

2.2 POMS database

The POMS database provides the other data needed to trace the history of a given traveler at the POE. The POMS database contains the *block time* for the flight[3] and also indicates how many

[2] Prior to this study, the integrity of the data in the two databases had not been evaluated nor compared to each other for consistency.

[3] Times in the two databases are expressed in two different time zones; IBIS times are EST and POMS times are recorded as local time (PST).

primary and secondary inspectors were on duty at the time the flight arrived. The arrival date, airline carrier code and airline flight number from each database can be cross-indexed to establish the time a traveler arrives at the gate. The flight logs and schedules for LAX for the month of June 2003 were provided by the CBP inspection staff at LAX.

The POMS data also indicate how many primary and secondary inspectors were on duty at the time the flight arrived. Finally, the flight data in POMS show the total number of travelers and a count of the following classes: visa waiver program passengers (VWP), crew, first time immigrants, and non-immigrants with visas. Although the POMS database is structured to record the numbers of U.S. citizens and legal permanent residents (*LPR*s), the exact number of these cannot be operationally determined and therefore must be estimated. Therefore, in our simulations the counts of these categories as well as non-immigrants exempt I-94s (e.g., Canadians) are combined and reported as one class.

2.3 IBIS and POMS data quality

Some data anomalies were encountered while analyzing the IBIS and POMS databases. Typical anomalies include:

1. Invalid visa-class-of-entry code – Certain invalid characters can be entered into this field in the IBIS database. Many records contained the code "***" in the COA field.
2. Multiple formats for data field – For example, "E37" was recorded in some records as "E37," and as "E-37" in others.
3. Missing data – For some IBIS records the visa-class-of-entry, document country, and document type fields were blank. If all three of these fields are missing for a given record, it is nearly impossible to assign a code to that traveler. There are also several records with document type "V" (visa) that have no "admit until date" or "limit time of stay" information. Finally, some flight data was missing, erroneously entered, or incomplete in some IBIS and POMS records.
4. Crew designation – Sometimes crewmembers are not distinguished from passengers. There does not seem to be a consistent format for indicating a traveler as "crew" in IBIS. Sometimes the character "C" is appended to the flight number, sometimes the visa-class-of-entry is marked as "CREW," or D1.

The IBIS records that did <u>not</u> contain a class-of-admission code were particularly problematic because this data field is required for accurate analysis and evaluation of US-VISIT implementation impacts and architectures. Of the 554,167 LAX records obtained from IBIS, there were 353,125 records for TBIT during the month of June 2003. 47.5% of these records pertained to U.S. citizens or LPRs who do not require a COA. Of the remaining records, 93% included a visa-class-of-admission code. 51% of the remaining records without a COA were assigned a visa code using business rules that are based upon document country and document type. These business rules are included in Appendix G. The remaining records that could not be assigned with these business rules were assigned a code of "other" (2% of the TBIT travelers during June 2003).

3.0 Data Analysis

As indicated in Fig. 3-1, the IBIS records are processed to generate *inspection time* distributions that are used by the simulation model. The class-of-admission fields and business rules discussed

in the preceding section are used to identify a traveler type (see Sec. 3.1). These completed records are further analyzed to generate inspection time distributions by type of traveler.

POMS flight records provide traveler counts for several types of travelers including VWP travelers, immigrants, and non-immigrant aliens that are used directly in the simulation. However, as stated in Sec. 2.2 the remainder of the passengers are aggregated into a single class for modeling purposes. As shown in the figure, monthly IBIS records are used to compute the fraction of each traveler type, which are in turn used to split this grouped POMS number into its constituent *traveler types* for use in the simulation model. These POMS traveler records with augmented type assignments are used to drive the simulation model.

During the course of the simulation, the inspection time distributions derived from the IBIS data are sampled and applied to individual travelers generated from the augmented POMS data. Details of some of these procedures are described in the following sections.

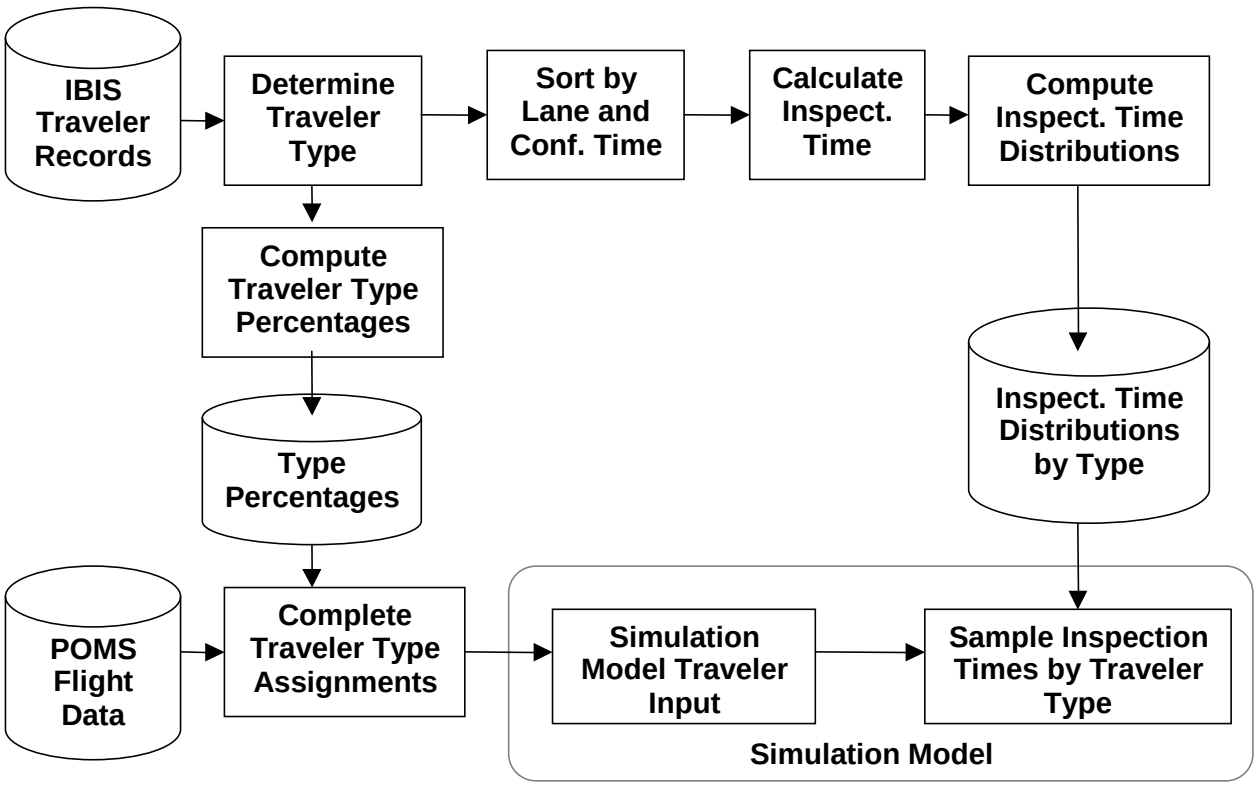


Figure 3-1 - Data Preparation and Use for Simulation Modeling

3.1 Inspection time distributions

The confirmation time stamps in the IBIS records provide a basis for calculating *inspection times* of the various types of travelers due to the implementation of the class of admission software. An underlying assumption of this analysis is that the second traveler was waiting for inspection in that lane at the time the first traveler was confirmed so that the entire time difference can be attributed to his inspection. If there is no one waiting in the queue for this lane at the time the first traveler is confirmed, the time difference between confirmation timestamps cannot be entirely attributed to inspection time of the second traveler and our methodology would overestimate the inspection time.

To prevent biasing the results, thresholds were set on inspection times to eliminate these cases from the distributions. The thresholds were determined by evaluating all process times for a particular traveler type, eliminating times that did not appear to be part of the real distributions. See **Appendix B** for details of the distributions.

For a given lane number, the difference between successive confirmation times indicates how long the inspection process for the traveler took. For example, the first two records in Appendix A show successive confirmation times for lane CU03. The first passenger is a 70 year-old female holding a Japanese passport entering under visa code WT (temporary visitor for pleasure). This passenger is confirmed at time 17:00:53 (hh:mm:ss). The second passenger is a 67 year-old male holding a Japanese passport also entering under visa code WT. This second passenger is confirmed at time 17:01:31. The difference between these two confirmation times implies an inspection time of 38 seconds for the second passenger.

The many non-immigrant visa classes of admission along with those for returning U.S. citizens and legal permanent residents were consolidated into 13 *traveler types*[4] for the purpose of best modeling inspection times or procedures. The types are shown in Table 3.1 and a cross-index between all visa classes and types are shown in Appendix E.

Table 3-1 - Traveler Types

0. U.S. citizen with passport
1. U.S. citizen without passport
2. Canadian with documentation
3. Canadian without documentation
4. Legal Permanent Residents (LPR)
5. Visa Waiver Program (VWP)
6. Crew
7. First time immigrant
8. Student, exchange visitor, and dependent visas (Student-NIV)
9. Other Non-immigrant with visa
10. Refugee
11. Not used
12. Other

3.1.1 Determination of Primary Inspection Time Distributions

The TBIT records were analyzed and process time distributions computed. Figure 3-2 shows an empirical distribution for all 102,127 type 0 TBIT travelers in June 2003 and a lognormal fit to the data. Note that the fitted lognormal distribution does not capture the double peaks in the distribution in the 10 to 40 second time range.

[4] Although 13 passenger types are listed, type 11 was reserved for future use so only 12 types of passenger types are used in our report.

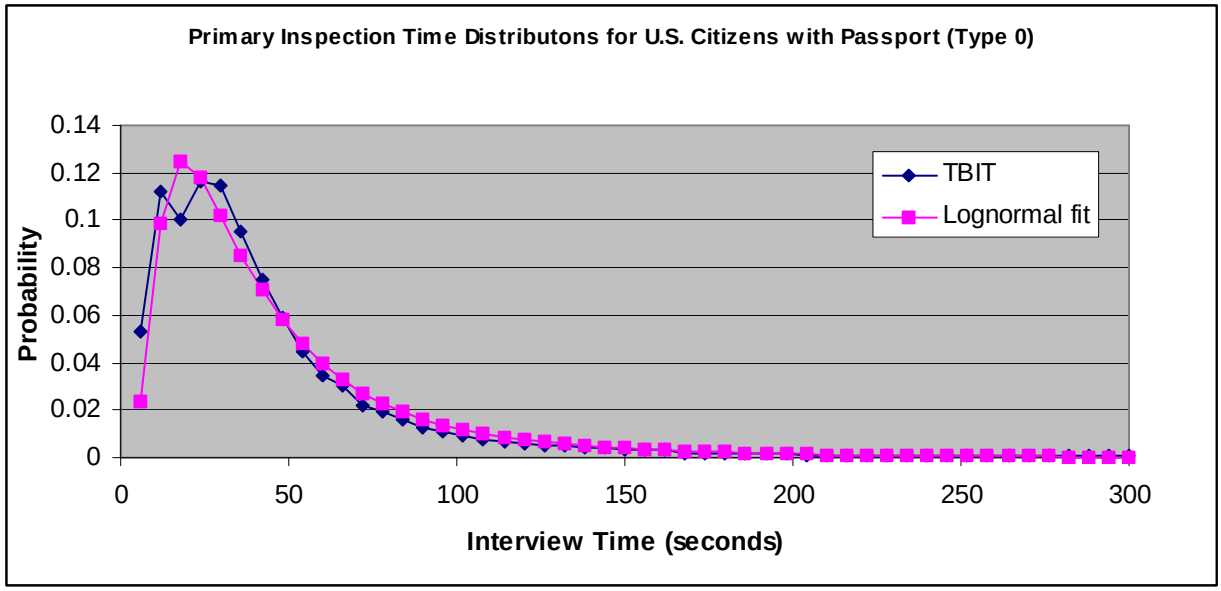


Figure 3-2 - Primary Inspection Time Distribution for U.S. Citizens with Passports

Data for traveler type 2 (U.S. Citizen without passport), type 5 (VWP), and 9 (NIV) also exhibited multiple peaks. Accordingly, we elected to sample directly from the TBIT empirical distributions to drive the simulation models rather than sample a fitted lognormal distribution. This sampling from empirical distributions generated from large datasets distinguishes this study from previous works.

Limited data were available for two of the traveler types — type 3 (Canadians without passports) and type 7 (first time immigrants)[5] — so the empirical distributions are less reliable for these traveler types. However, given the infrequent observations of these types, errors in these distributions are unlikely to have significant impact on the results.

Figure 3-3 shows the number of travelers by type for June 25th, 2003. As indicated by the data in the figure, most of the travelers are U.S. citizens with passports, non-immigrant visa holders, and citizens of countries participating in the Visa Waiver Program.

[5] IBIS crossing records indicate that 104 first time immigrants were admitted at LAX for the month of June, however the Inspections field workload report (G22.1) for LAX indicates that a total of 3,966 were processed at the POE.

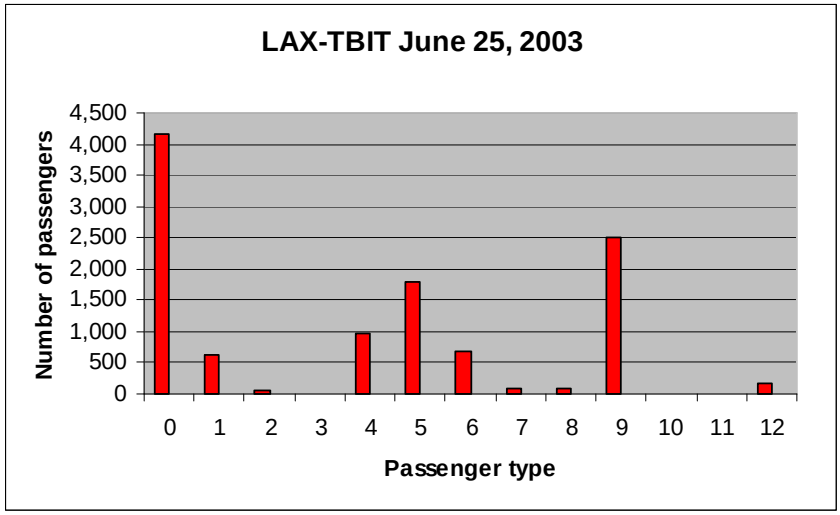


Figure 3-3 - Number of IBIS Travelers for June 25, 2003

3.2 Average wait times

Currently, there is no available dataset that indicates how long a traveler waits in a queue to be inspected; however IBIS and POMS data together provide the basis for modeling the wait time based upon the following: The *primary inspection cycle time* (time to deplane and walk to *primary queue* + *queue time* + *inspection time*) can be determined using the flight block times in POMS in combination with the primary confirmation time in IBIS. If deplane and *walk time* are subtracted from primary inspection cycle time, the remaining value is *wait time* (queue time + inspection time). Daily wait times of U.S. and non-U.S. citizens for all of LAX were calculated based on a sample size of 161,646 during the month of June, and are shown in Fig. 3.4.

As the figure indicates, there is significant day-to-day variation in wait times. Wait times are relatively low on Tuesdays, and significantly higher on Sundays. Wait times vary by more than a factor of two between low and high days. Wednesday, June 25th, a moderately high load day, was selected for the analysis.

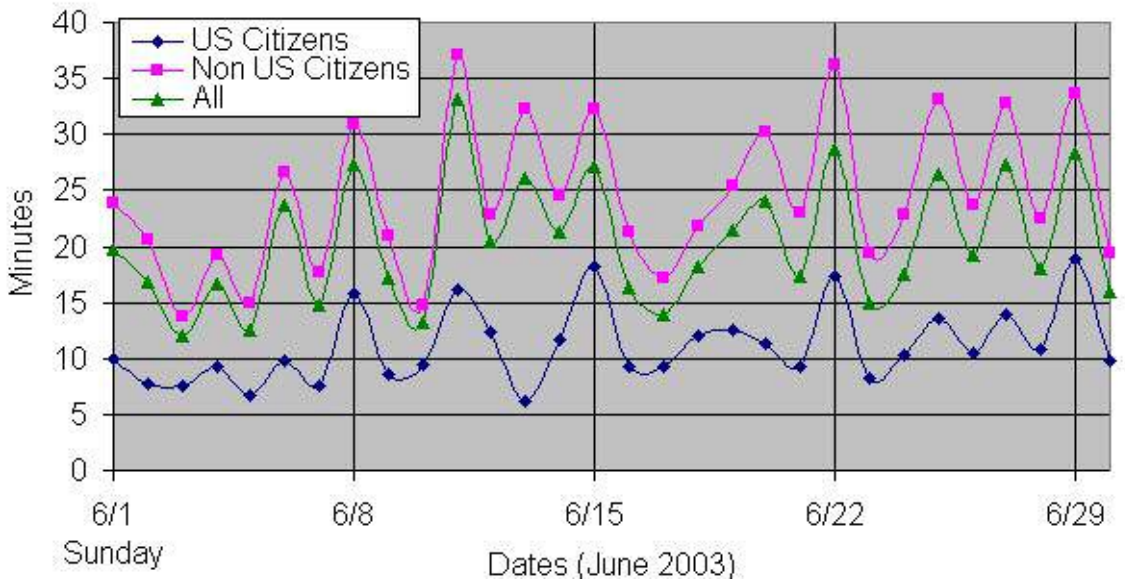


Figure 3-4 - Wait Times at LAX Airport TBIT

4.0 Simulation Model Architecture

A discrete event simulation model was developed using the Extend™ 6.0.3 commercial software package. Views of the graphical interface of the model are shown in Appendix C. The model includes approximately 400 modules from the Extend libraries.

4.1 Traveler arrivals generation and characterization processes

The total number of arriving travelers and the flight arrival time were extracted from the flight logs to drive the simulation model (see Figs. C.1 and C.2). As discussed in Sec. 3.0, the IBIS data are used to further refine the number of each type of traveler for each flight (see Appendix D).

Traveler timing and sequencing at the primary inspection queue is influenced by deplaning activities and walking from the gate to the queue. By observing POMS data, an average deplane and walk time of 10 minutes was used for the analysis. Note that simply adding the walk time for a particular flight to the block time would place all travelers from a particular flight at the primary queue at the same instant. This large bulk arrival event would tend to overestimate wait time relative to a more realistic process in which travelers deplane at different times and walk to the primary queue at different speeds. Accordingly, each traveler is delayed by a random amount uniformly distributed between 5 and 15 minutes to reflect an average walk time of 10 minutes with a variation of +/- 5 minutes about that mean.[6]

Each traveler is then assigned an inspection time based upon a sample from the appropriate distribution for that traveler type. The probability that the traveler will be referred to *secondary inspection* based upon interview responses can also be assigned to the traveler. Finally, a unique identification number is assigned to each traveler for use in the simulation model so that biometric information can be associated with the traveler throughout the simulation.

4.2 Queue for primary inspection

The authors went onsite to LAX to observe actual inspections and queuing. Three types of primary inspection queues were present at LAX's TBIT and are represented in the model: U.S. citizen lanes, alien lanes, and crew lanes (see Fig. C.3). We observed that as travelers arrive they are routed into their corresponding queue. At TBIT, if the line in one of the queue types becomes inordinately long, travelers may be rerouted to a queue type with lower current utilization. For example, if a floor supervisor observes that there are 500 aliens waiting for inspection in the alien queue, while there are only a few U.S. citizens in line, she may choose to reroute aliens into one of the U.S. citizen queues. To enable this behavior in the simulation model, U.S. citizen and alien queue lengths are monitored and non-U.S. citizens are allowed to move from their native queue to the U.S. citizen queue if their expected queue time is significantly higher than that in the other queues. In general, an attempt is made to expedite the inspection of U.S. citizens and LPR's over other passengers. To simulate this, an *alien lane crossover rate* parameter is included in the model architecture to allow control over the flow of aliens from the alien queue to the U.S. queue in order to preserve performance levels for U.S. citizens. For the *Base Case* Scenario, this alien crossover rate parameter was set to zero.

[6] Note that if a constant deplane or walk time is added to all passenger histories, the computed average wait time is not affected. The added constant simply delays both entry into the system and exit from the system by the same amount. The numerical difference between entry and exit time is not affected by adding a constant to both factors.

The simulation model was also designed to permit automated inspections at kiosks[7] (see Fig. C.1) that could be used to process travelers as determined by statute or policy. These kiosks are not currently used by the model but could be to demonstrate their usage rates and effects on other resource needs and overall wait and inspection times. As indicated in the figure, each traveler could be checked to see if the traveler type is amenable for use of the kiosks. If the traveler is not approved for use of the kiosk, the traveler is routed to the current primary inspection queues. If the traveler attempts to use the kiosk and is denied, the model is designed to route that traveler to a primary inspector.

4.3 Inspector staffing

As indicated previously, number of inspectors on primary for each flight is recorded in the flight logs. However, the flight logs do not indicate how many lanes were dedicated to inspecting U.S. citizens vs. aliens. The traveler types derived from IBIS records for the month of June were used to infer the number of U.S. citizen, crew and other lanes in use throughout the modeled 24-hour period.

4.4 Traveler inspection process

As shown in Fig. C.4, the model accommodates three biometrics-based traveler inspection processes in addition to the current process. They are:

1. No biometrics (the current process)
2. Fingerprints only
3. Face recognition only
4. Fingerprints and face (no face recognition)

Each traveler can be routed through one of these four processes. Processes 2-4 presume that certain biometrics are checked during primary inspection. Non-immigrant visa holders (NIVs) that are 'pre-enrolled'[8] in the system are modeled as requiring only a 1-to-1 verification check against existing visa records in the US-VISIT database and that a 1-to-n check against the watchlist has been conducted prior to arrival of the traveler at the POE. This scenario also assumes that all travelers are preenrolled and that the pre-enrolled alien's biometric file can be determined accurately in advance of the alien's arrival. This is due to the fact that currently (US-VISIT Increment 1) the unique biometric data record is retrieved from the database using a text-string search of biographic and document data. If the NIV bearer is not enrolled or his record cannot be found, a 1-to-n check against a watchlist and enrolled database must be executed. The I-to-n watchlist check is performed during the primary inspection. However the 1-to-n check against the US-VISIT enrollment database, while initiated during the primary inspection, may not be completed until after the primary inspection[9]. Percent enrolled, time for 1-to-1 queries, and 1-to-n search times are also parameters in the simulation model. A process model has also

[7] The INS Passenger Accelerated Service System (INSPASS) was operational at TBIT during the time of our study. Due to its relatively low usage; it was not included in the simulation.

[8] Pre-enrolled in this paper and in the US visit context refers to only to the prior acquisition of biometric data and is not the same as the term pre-enrolled for current automated inspection processes such as SENTRI.

[9] The current number of enrollment records the system is capable of returning match results or creating a unique fingerprint identification number during the inspection. However, when it does, that information is not made available to the inspector. As the size of the enrollment database increases it is anticipated that the full query and response may, with current resources, take up to 24 hours.

been developed in the model for visa waiver passengers from countries that have passports with a machine-readable and verifiable digital photo stored in the passport. In this process, the captured photo is compared against the digitally encoded photo and compared against a watchlist.

Figures C.5 and C.6 show details of the biometrics modeling. Although each simulation run will generate different results, typical output is shown in Fig. C.7.

5.0 Analysis Results

5.1 Model validation with IBIS Benchmark

The IBIS Benchmark Scenario simulation model was used to simulate the IBIS data for a single 24-hour period (June 25). Analysis of the June 25 IBIS records indicate that the mean wait time (primary queue time + inspection time) for all travelers at the LAX Tom Bradley International Terminal (TBIT) was 26.5 minutes. The model was configured to simulate the process. The simulation results using the POMS flight data are shown in Appendix D and estimated primary inspection time distributions are shown in Appendix B.

As discussed in Sec. 4.3, the lane assignments for June 25 TBIT, which was inferred from analysis of the IBIS records, is shown in Table 5.1 for the three types of queues.

Table 5-1 - Lane Assignments for Primary Inspections at LAX-TBIT for June 25

Time (sec) Start	Time (sec) End	Time (hr) End	Number of Inspectors Inspecting U.S. Citizens	Number of Inspectors Inspecting Other Passengers	Number of Inspectors Inspecting Crew
0	3600	1:00	5	9	1
3600	7200	2:00	5	12	1
7200	14400	4:00	2	2	1
14400	43200	12:00	2	4	1
43200	46800	13:00	4	8	1
46800	50400	14:00	9	9	1
50400	54000	15:00	10	12	1
54000	57600	16:00	10	13	1
57600	61200	17:00	10	10	1
61200	64800	18:00	10	12	1
64800	72000	20:00	10	16	1
72000	75600	21:00	5	9	1
75600	86400	24:00	5	5	1

The simulation model was executed with the POMS staffing schedule, flight arrival time and traveler manifest data. As a result, for the 24-hour period at TBIT, the model simulated the inspections of 11,102 travelers arriving on 55 flights at TBIT on June 25.

To estimate the mean and variance of the wait time, 10 simulation runs were made. The simulation model output is shown in Fig. C.7. As shown in the left hand side of the figure, the

simulation model predicts a wait time of 27.9+/-3.9 minutes. The 26.5 minute mean computed with the sampled IBIS records is within the 95% confidence interval determined by the model [10]. The maximum queue length for each of the 10 simulation runs was also recorded. As indicated in the lower left corner of the figure, the mean of this maximum queue length for these runs was 1190+/-93.0 passengers.

Typical queue times for U.S. citizens and non-citizens are shown in the upper and lower graphs in the figure, respectively[11]. The blue line with the higher peaks corresponds to the number of passengers waiting in the queue as measured against the left hand scale. As shown on the top graph, the number of passengers in the U.S. queue peaks at approximately 300 at 7:12 p.m. (69,120 seconds). The queue time of the last person to leave the queue is denoted by the red line, which is measured against the right hand scale. The peak queue time of 28 minutes occurs just after the peak queue length. As shown in the bottom graph, the peak queue length and wait times for non-U.S. citizens are 800 persons and 135 minutes, respectively. Note that the peak wait time for non-U.S. citizens occurs approximately 2.5 hours after the peak queue length. At the end of the simulation run, midnight EST on June 25, there are 561+/-115 passengers in the U.S. citizen and other queues. ADIS and IBIS data suggest that there were 450 travelers waiting in the primary queue at the end of the 24-hour period.

5.2 Base Case (As-Is) Scenario

As indicated in Sec. 5.1, the benchmark model shows 561 passengers in the primary inspection queue at the end of the day. The IBIS records show that these passengers are inspected the next day, so their confirmation time stamps and wait time statistics would be included in the IBIS dataset for June 26. To provide a more accurate representation of inspections for June 25, the average wait time for the *Base Case* Scenario includes the wait times of those passengers in the queue at the end of June 25. Accordingly, the simulation time is extended to include 00:00-03:00 hours on June 26, however flights only arrive in the initial 24 hour period. The average wait time for all travelers processed during this 27-hour period for the ten runs is 30.3 +/- 4.6 minutes, the maximum queue length is 1190+/-94 passengers, and the ending queue is 0. Note that more effective lane management can reduce the average wait time. For example, if the alien crossover rate is set to 20% so that U.S. Citizen inspectors are more effectively utilized, the average wait time for the base case is reduced to 21.1 +/1 2.4 minutes.

5.3 Scenario 1 – NIV Prints and Photo

In this scenario, all of the 2,578 non-immigrant visa holders (types 8 and 9)[12] were required to enroll their fingerprints and photo in a database prior to entry into the U.S.[13]. At primary

[10] Simulation results are reported as a mean and a 95% confidence interval for the mean. The 95% confidence interval is approximately equal to the mean plus or minus two standard deviations.

[11] Because random sampling drives the simulation model, each simulation run will generate somewhat different outcomes.

[12] The simulations in this study did not exclude certain non-immigrant visa holders specifically exempted from US-VISIT Increment 1 processing by policy. Additionally, alien crew in possession of D-1 visas (Traveler type 6) were not included in the simulations.

[13] Although it is recognized that initially NIV holders will not be pre-enrolled, our analysis indicates that as long as the biometric query and response times remain less than the time it takes to inspect an NIV holder and that the biometric query and inspection occur concurrently there is no need to model for less than 100% enrollment.

inspection, fingerprints are reacquired and electronically compared to the person's prints on file by *IDENT*. A live photo is also acquired, visually compared by the inspector to the photograph on file, and archived.

Assumptions regarding this scenario are as follows:

1. 10 seconds[14] required to acquire prints (increase in overall inspection time)
2. 5 seconds required to acquire photo (increase in overall inspection time)
3. 100% of NIVs are enrolled prior to arrival
4. 5 seconds computer and communication time required to check prints (done in parallel with interview)
5. No automated face recognition technology
6. Simulation time 00:00 hours (EST) June 25 through 03:00 (EST) hours June 26

The wait time for this scenario is 43.2+/-5.4 minutes, an increase of 12.9 minutes over the Base Case. Relative to the Base Case, the maximum primary queue length increases by 184 passengers to 1374+/ 108. A typical ending primary inspection queue at the end of the simulation run is 0.

The cumulative distributions of traveler wait times for the Base Case and Scenario 1 are shown in Fig. 5.1. The upper curve in the figure indicates that, in the Base Case with no biometrics, 50% of the travelers wait less than 20 minutes and 95% of the travelers wait less than 90 minutes. For Scenario 1, the 50th and 95th percentiles are 22 minutes and 145 minutes, respectively.

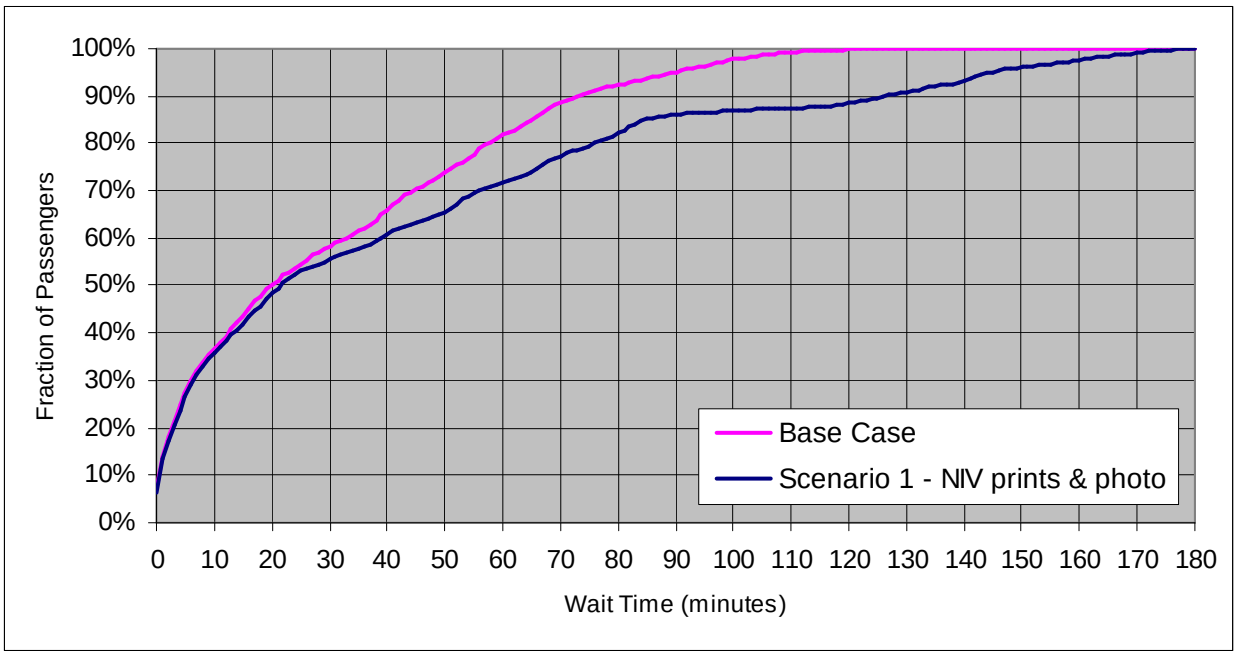


Figure 5-1 - Wait Time Cumulative Probability Distribution Function

[14] When and where possible, these model parameters are based on input from IDENT Program managers.

5.3.1 Sensitivity study of print and photo acquisition time

A sensitivity study was conducted to explore the impact of increased print and photo acquisition times over the baseline assumption of 15 seconds (10 seconds for prints and 5 seconds for photo). Results are show in Figs. 5.2 and 5.3. Print and photo acquisition times of 0 seconds in Figs. 5.2 and 5.3 would correspond to the Base Case scenario with no prints or photo.

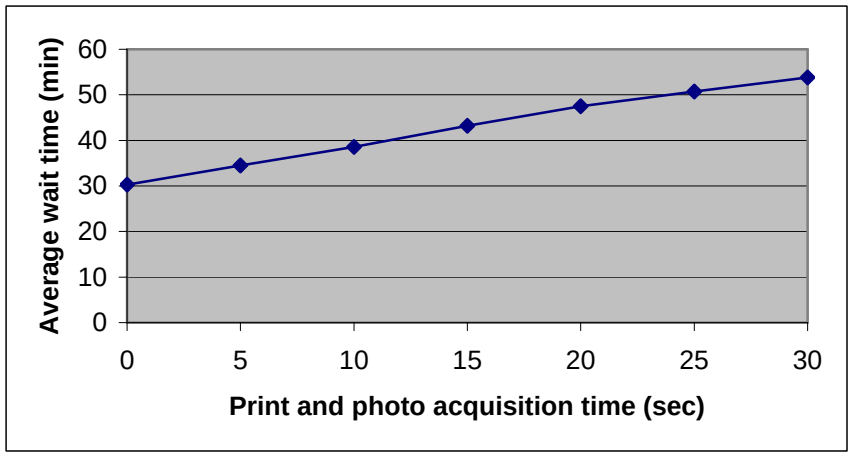


Figure 5-2 - Wait Time vs. Biometrics Acquisition Time

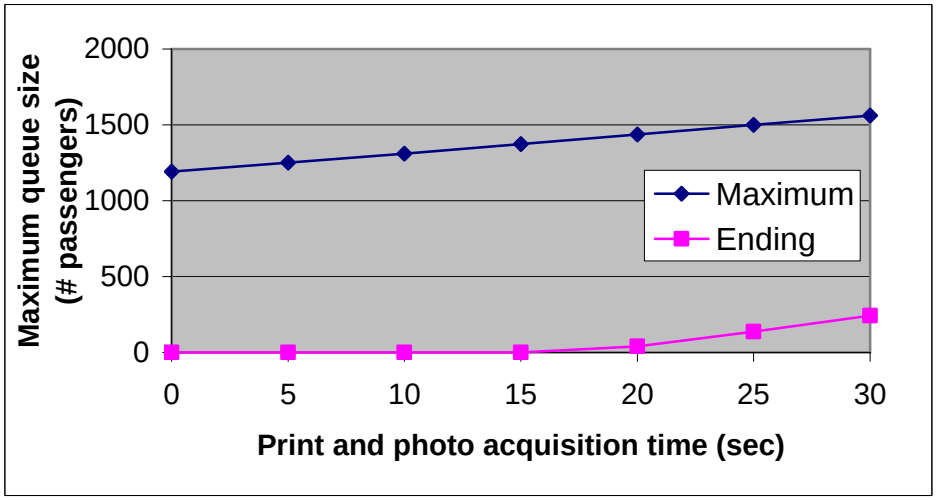


Figure 5-3 - Maximum Queue Size vs. Biometrics Acquisition Time

As indicated by the data in the figures, the average wait time increases by 4 minutes and the maximum queue length increases by about 60 travelers for every 5 second increase in print and photo acquisition time. These numbers can be used as a "rule-of-thumb" for trade-offs in systems design parameters vs. impact on travelers for similar type and sized operations. Another key performance measure is the ending queue length, as travelers in the queue at the end of the 27-hour simulation period have been waiting at least three hours. This ending queue becomes greater than zero for print and photo acquisition times greater than 15 seconds. The travelers in this ending queue have been waiting over three hours. This suggests 15 seconds for print and photo acquisition as a design goal for US-VISIT (assuming current staffing at TBIT and strict segregation of US Citizens and alien travelers at the primary inspection lanes).

As discussed in Sec. 5.3, implementation of US-VISIT could significantly affect traveler wait time. These calculations are based upon our Base Case Scenario, which segregates U.S. citizens

from all alien passengers. Two independent modifications of the Base Case Scenario were made. In the first modification, LPRs are allowed to wait in the same queue as U.S. citizens (as is current practice). This measure would result in a average wait time of 26.2+/-3.2 minutes, a maximum queue length of 1119+/-82 travelers, and an ending queue length of 0 travelers. Relative to the Base Case Scenario, the average wait time decreases 4.1 minutes, maximum queue length decreases 71 travelers, and ending queue length is zero.

The second modification explored involved rerouting some percentage of all alien passengers to the U.S. citizen inspection lanes when the expected queue time in those lanes is lower. To this end, the alien crossover parameter was set to 20%. Introduction of this crossover behavior would result in an average wait time of 27.4+/-3.4 minutes, a maximum queue length of 1194+/- 68 travelers, and an ending queue length of zero travelers. Relative to the Base Case Scenario, the average wait time decreases 2.9 minutes, maximum queue length increases by 4 travelers, and ending queue length is zero.

5.4 Scenario 2 – VWP Face Recognition

In this scenario, it is assumed that all VWP passengers will be in possession of advanced travel documents. This scenario assumes that processes for NIVs in Scenario 1 are not being implemented simultaneously. The following assumptions apply for this scenario:

1. 5 seconds additional time required to take live photo at primary inspection
2. 10 seconds required to verify photo (1-to-1) and check against facial watchlist
3. 100% of the VWP passengers are in possession of an accredited biometric encoded passport

The average wait time for this scenario increases by 3.5 minutes to 33.8+/-4.6, relative to the Base Case ("as-is") scenario. The maximum queue length is 1250+/-101, an increase of 60 passengers.

5.5 Scenario 3 – NIV Prints + VWP Face Recognition

In this scenario, NIV passengers are fingerprinted and live photos are visually compared to photos on file. For VWP passengers, face recognition software is used, but no fingerprints are taken. The assumptions for this case are the same as those in Scenario 1 for NIVs and Scenario 2 for VWPs.

The average wait time for this scenario increases by 16.1 minutes to 46.4 +/- 5.0, relative to the Base Case Scenario. The maximum queue length is 1424 +/- 108, an increase of 234 passengers relative to the Base Case.

5.6 Scenario 4 – NIV holders and VWP travelers (prints and photo)

One possible inspection alternative would be to process all Visa Waiver passengers under Scenario 1 conditions, with the alternative assumptions that none would be 'pre-enrolled' and, that over time, many travelers will be reencountered and inspected as pre-enrolled NIV holders, e.g. 1-to-1 checks only.

NIV and VWP common assumptions

1. 15 seconds[15] required to acquire prints and capture photo
2. Simulation time 00:00 hours (EST) June 25 through 03:00 (EST) hours June 26

NIV assumptions

1. 100% of NIVs are enrolled prior to arrival
2. 5 seconds computer time required for 1-to-1 check prints

VWP holder assumptions

1. 0% of VWPs are enrolled prior to arrival
2. 8 seconds computer time required for 1-to-n check prints

The average wait time for this scenario increases by 21.0 minutes to 51.3 +/- 4.5, relative to the Base Case Scenario. The maximum queue length is 1521 +/- 108, an increase of 334 passengers relative to the Base Case.

The queue length at the end of the 27-hour simulation period is approximately 150 travelers. These travelers have been waiting in excess of three hours. The two mitigation measures described in Sec. 5.3.1, sending LPRs to the U.S. citizen primary inspection queue and setting the alien crossover rate to 20%, can be used to eliminate these ending queues. Sending LPRs to U.S. citizen inspection queues reduces the average wait time to 34+/-3.0 minutes while setting the alien crossover rate to 20% reduces the wait time to 35.7+/-2.9 minutes.

6.0 Summary of Modeling Simulations

Simulation results are summarized in Table 6.1. Average wait times for all travelers and maximum queue lengths for primary inspection are reported, as well as changes in these performance measures relative to the Base Case Scenario ("as-is system"). As indicated by the data in the table, introduction of 100% pre-enrolled biometrics into US-VISIT (Scenario 1) would increase the average wait time for travelers by 12.9 minutes to 43.2 minutes. The maximum queue length increases by 184 travelers to 1374.

Analysis of the VWP Face recognition Scenario 2 indicates that the addition of advanced travel documents and face recognition software at primary would increase the overall wait time by 3.5 minutes and maximum queue length by 60 travelers.

Implementation of the system represented in Scenario 3, which includes acquisition of prints and photos for NIV passengers and photos for VWP passengers, would increase the mean wait time by 16.1 minutes and maximum queue length by 234 travelers.

Recognizing that participating countries in the Visa Waiver Program may not be able to meet the legislative date to produce biometric enabled passports and/or facial recognition software may not be mature enough to support the legislative mandate, policy decisions may need to be made as to how to inspect these passengers to support border and homeland security needs afforded us

[15] When and where possible, these model parameters are based on input from IDENT Program managers.

the possibility to model a Scenario whereby all non-exempt NIV holders AND VWP passengers were all processed under Scenario 1. The single difference is that for VWP passengers that there would be no corresponding visa file on record against which to compare their photos. Implementation of Scenario 4, which directs VWP and NIV holders through Scenario 1 processes — fingerprint verification — would increase the mean wait time by 21.0 minutes and maximum queue length by 334 travelers.

Table 6-1 - Summary of results

	Scenario	Primary queue average wait time (min.)	Change in average wait time (min.)	Primary queue maximum length (# people)	Change in queue length
0	Base Case ("as-is")	30.3 +/-4.6	-	1190+/-94	-
1	US-VISIT (NIV prints & photo)	43.2+/-5.4	+12.9	1374+/-108	+184
2	VWP Photo	33.8+/-4.6	+3.5	1250+/-101	+60
3	NIV prints, photo + VWP photo	46.4+/-5.0	+16.1	1424+/-108	+234
4	NIV holders and VWP Travelers (prints and photo)	51.3+/-4.5	+21.0	1521+/-108	+334

7.0 Recommendations

As noted in the text of this report there were several instances where data needed to make the simulations more accurate was not available when it should have been and lacked edits and consistency. Of major concern is that this data set is the one upon which all the Increment 1 processing is being performed. One of the goals or objectives of any new or improved electronic arrival and departure system is to have data that is as accurate as possible. It is highly recommended that as the project moves forward that data being collected, the manner in which it is collected, and the edits (if any) that are applied be reviewed on a continual basis for quality assurance.

Based on our site visit in August 2003 and other anecdotal reports, system availability and slow response times are a concern to end-users. It is strongly recommended that a backup or local system be developed to address periods when centralized system performance is slow or unavailable. Since the site visit, it has been reported that the mainframe capacity has been doubled and telecommunications have been upgraded at LAX as well as at all major air POEs which should serve to alleviate some of these problems.

Print and photo acquisition times in excess of 15 seconds result in end of day queues that are non-zero. Since travelers waiting in the queue at the end of the 27-hour simulation period will have been waiting in excess of 3 hours, a maximum of 15 seconds is suggested as a design goal for biometric acquisition systems.

Future versions of the model will have more robust inspector allocation logic and can be driven by IBIS records rather than POMS flight schedules. It is strongly recommended that IBIS be modified to include flight block time.

Appendix A Sample IBIS Records Used for Modeling

Conf. date	Conf. time hhmmss	Lane no.	Site ID	IATA airport code	INS Port code	Flight ETA date	Sec. Code	L.O. Code	Airline carrier code	Flt. Num.	Depart. airport	Gender	Passenger DOB ccyymmdd	Doc. type	Doc. country code	Visa class of entry	Admittance until date	Limit of stay time
20030625	170053	CU03	A273	LAX	LOS	20030625	N	N	JL	60	KIX	F	19330110	P	JP	WT	20030923	90
20030625	170131	CU03	A273	LAX	LOS	20030625	N	N	JL	60	KIX	M	19361216	P	JP	WT	20030923	90
20030625	170336	CU03	A273	LAX	LOS	20030625	N	N	OZ	202	ICN	M	19450630	P	KR	B2	20031224	182
20030625	171003	CU03	A273	LAX	LOS	20030625	N	N	LH	456	FRA	M	19441012	P	IT	WB	20030923	90
20030625	171202	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19180315	P	US		0	0
20030625	171342	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19310119	V	IN	B2	20031224	182
20030625	171415	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	M	19290918	V	US	B2	20031224	182
20030625	171755	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19270906	P	JP	LPR	0	0
20030625	171822	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	M	19300528	P	US		0	0
20030625	171906	CU03	A273	LAX	LOS	20030625	N	N	MH	94	KUL	M	19720626	V	TW	B2	20031224	182
20030625	172246	CU03	A273	LAX	LOS	20030625	N	N	LX	40	ZRH	F	19440228	P	SE	WT	20030923	90
20030625	172308	CU03	A273	LAX	LOS	20030625	N	N	LX	40	ZRH	M	19450628	P	CH	WT	20030923	90
20030625	172611	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19640516	V	SG	B2	20031224	182
20030625	172847	CU03	A273	LAX	LOS	20030625	N	N	CI	6	TPE	M	19630308	P	US		0	0
20030625	173227	CU03	A273	LAX	LOS	20030625	N	N	LH	456	FRA	F	19301007	P	DK	WT	20030923	90
20030625	174504	CU03	A273	LAX	LOS	20030625	N	N	OZ	202	ICN	F	19301011	V	KR	B2	20031224	182
20030625	174550	CU03	A273	LAX	LOS	20030625	N	Y	OZ	202	ICN	F	19590710	P	KR	B2	20031222	180
20030625	175936	CU03	A273	LAX	LOS	20030625	N	N	RG	8837	NRT	F	19811009	P	JP	WT	20030923	90
20030625	180344	CU03	A273	LAX	LOS	20030625	N	N	LX	40	ZRH	F	19830417	P	GB	WT	20030923	90
20030625	181053	CU03	A273	LAX	LOS	20030625	N	N	MX	920	MEX	F	19481113	C	US	LPR	0	0
20030625	181244	CU03	A273	LAX	LOS	20030625	N	N	MX	920	MEX	F	19880307	F	US	USC	0	0
20030625	181630	CU03	A273	LAX	LOS	20030625	N	N	MH	94	KUL	F	19651105	V	TW	B2	20031224	182
20030625	182141	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	M	19360124	V	IN	B2	20031224	182
20030625	182221	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19401101	V	IN	B2	20031224	182
20030625	182402	CU03	A273	LAX	LOS	20030625	N	N	AF	62	G	M	19590929	P	IT	WT	20030923	90
20030625	182513	CU03	A273	LAX	LOS	20030625	N	Y	BA	283	LHR	M	19631024	P	US		0	0
20030625	182721	CU03	A273	LAX	LOS	20030625	N	N	BA	283	LHR	M	19310914	P	GB	WT	20030923	90
20030625	182737	CU03	A273	LAX	LOS	20030625	N	N	BA	283	LHR	F	19290712	P	GB	WT	20030923	90
20030625	183114	CU03	A273	LAX	LOS	20030625	N	N	BA	283	LHR	M	19800917	P	US		0	0
20030625	183253	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	M	19331118	P	SG	WT	20030923	90
20030625	183313	CU03	A273	LAX	LOS	20030625	N	N	SQ	12	SIN	F	19391025	P	SG	WT	20030923	90
20030625	183841	CU03	A273	LAX	LOS	20030625	N	N	MX	920	MEX	M	19261021	P	US		0	0
20030625	184145	CU03	A273	LAX	LOS	20030625	N	Y	MX	920	MEX	M	19290319	V	US	B2	20031224	182
20030625	184248	CU03	A273	LAX	LOS	20030625	N	N	CI	6	TPE	M	19581102	V	US	B1	20030724	29

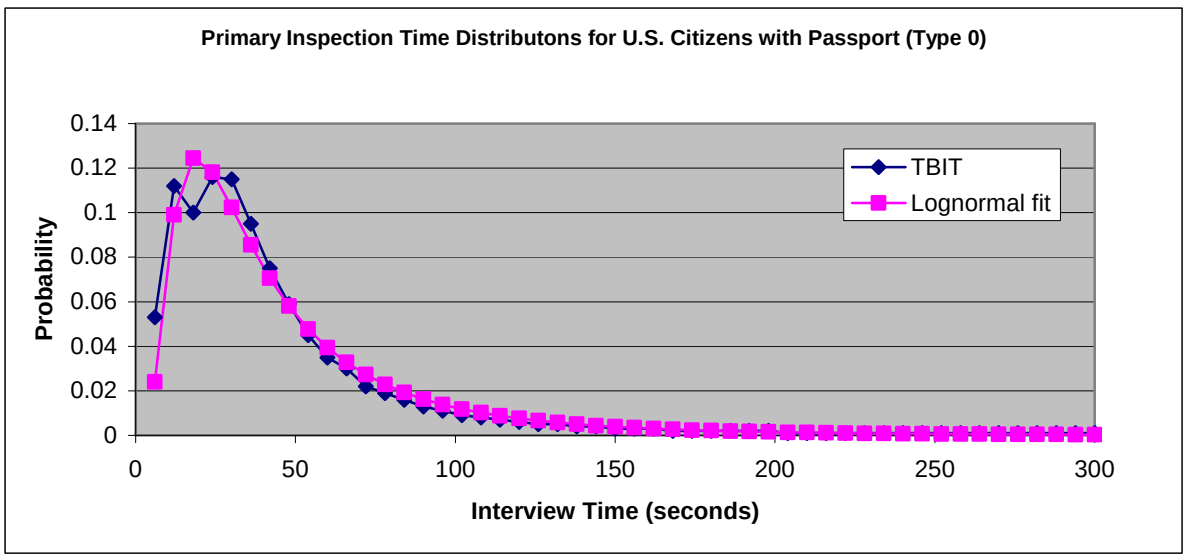
Appendix B Inspection Time Probability Distributions by Class-of-Admit

Table B-1 - Sample sizes for primary inspection time distributions by traveler type

Traveler type	Sample size for TBIT distributions
0	102,127
1	15,431
2	1,408
3	2
4	23,018
5	52,199
6	17,374
7	63
8	2,414
9	77,219
10	23
11	-
12	5,188
total	**296,466**

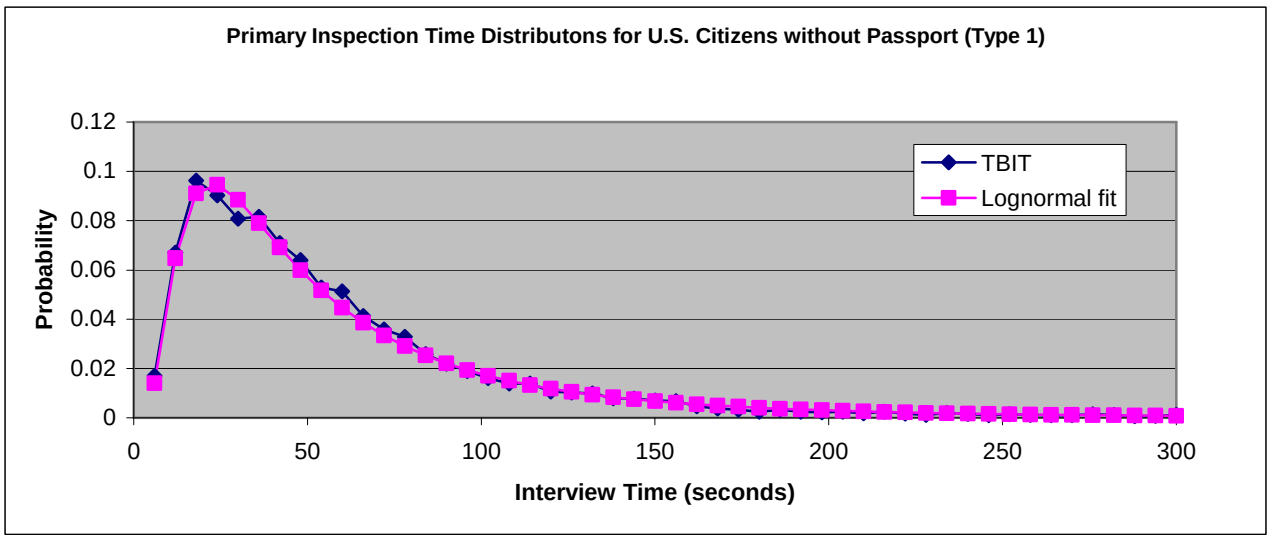
B.0 U.S. citizens with passports

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.053000	0.024026	162	0.003000	0.003005
12	0.112000	0.098972	168	0.002000	0.002665
18	0.100000	0.124512	174	0.002000	0.002369
24	0.116000	0.118157	180	0.002000	0.002110
30	0.115000	0.102290	186	0.002000	0.001885
36	0.095000	0.085514	192	0.002000	0.001687
42	0.075000	0.070559	198	0.002000	0.001513
48	0.059000	0.058017	204	0.001000	0.001359
54	0.045000	0.047758	210	0.001000	0.001224
60	0.035000	0.039444	216	0.001000	0.001104
66	0.030000	0.032723	222	0.001000	0.000998
72	0.022000	0.027281	228	0.001000	0.000903
78	0.019000	0.022860	234	0.001000	0.000819
84	0.016000	0.019252	240	0.001000	0.000744
90	0.013000	0.016293	246	0.001000	0.000676
96	0.011000	0.013854	252	0.001000	0.000616
102	0.009000	0.011834	258	0.001000	0.000562
108	0.008000	0.010153	264	0.001000	0.000513
114	0.007000	0.008746	270	0.001000	0.000470
120	0.006000	0.007563	276	0.001000	0.000430
126	0.005000	0.006565	282	0.001000	0.000394
132	0.005000	0.005718	288	0.001000	0.000362
138	0.004000	0.004998	294	0.001000	0.000333
144	0.004000	0.004382	300	0.001000	0.000306
150	0.003000	0.003853			
156	0.003000	0.003398			



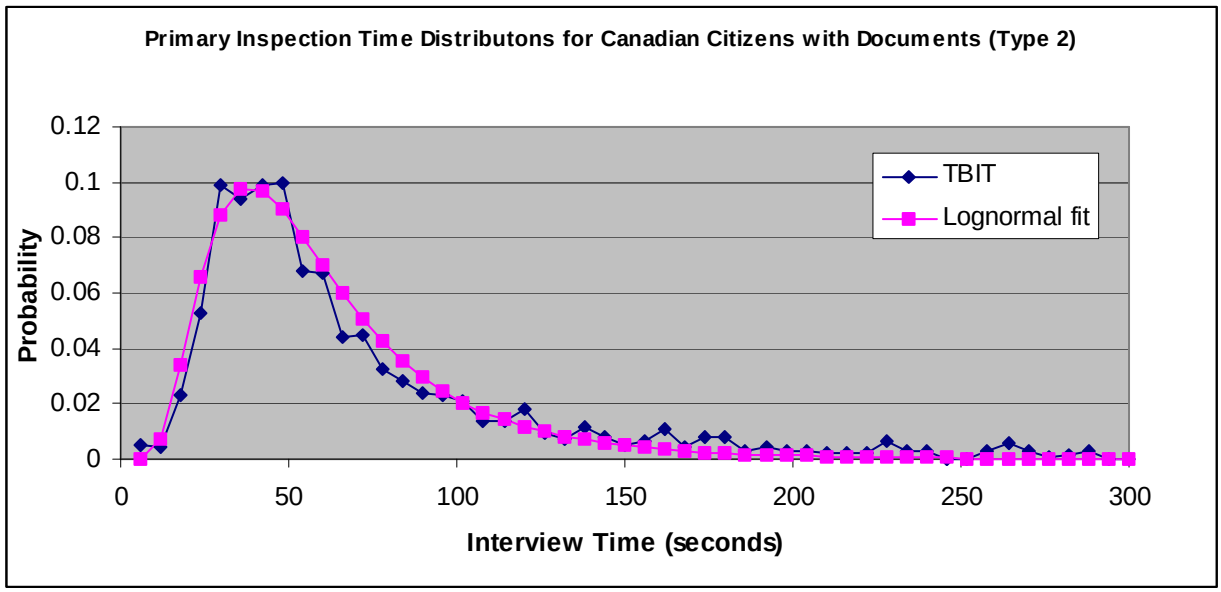
B.1 U.S. citizens without passports

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.016979	0.014060	162	0.004731	0.005478
12	0.067008	0.064795	168	0.003823	0.004952
18	0.096235	0.090957	174	0.003240	0.004486
24	0.090273	0.094529	180	0.002527	0.004070
30	0.080682	0.088369	186	0.003240	0.003701
36	0.081524	0.078965	192	0.002527	0.003370
42	0.070831	0.069114	198	0.002203	0.003074
48	0.064027	0.059925	204	0.002527	0.002809
54	0.052881	0.051769	210	0.001879	0.002570
60	0.051325	0.044699	216	0.002463	0.002355
66	0.041281	0.038640	222	0.001685	0.002161
72	0.035902	0.033475	228	0.001231	0.001986
78	0.032921	0.029078	234	0.001944	0.001828
84	0.025857	0.025333	240	0.001620	0.001684
90	0.022034	0.022139	246	0.001037	0.001554
96	0.018988	0.019408	252	0.001491	0.001435
102	0.016136	0.017067	258	0.001231	0.001327
108	0.013868	0.015053	264	0.001102	0.001228
114	0.013868	0.013315	270	0.001102	0.001138
120	0.010693	0.011812	276	0.001426	0.001056
126	0.010239	0.010507	282	0.001231	0.000981
132	0.009850	0.009370	288	0.000713	0.000912
138	0.007971	0.008378	294	0.000842	0.000848
144	0.007841	0.007508	300	0.001166	0.000790
150	0.006999	0.006744			
156	0.006804	0.006072			



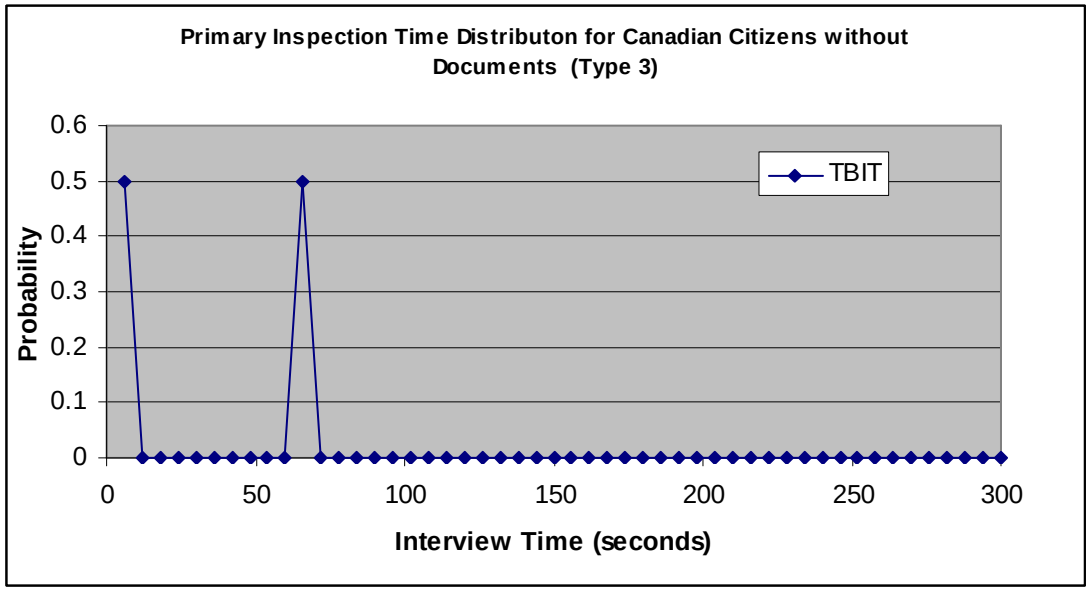
B.2 Canadian citizens with documents

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.004972	0.000143	162	0.010653	0.003449
12	0.004261	0.007279	168	0.004261	0.002918
18	0.023438	0.033619	174	0.007813	0.002474
24	0.052557	0.065732	180	0.007813	0.002102
30	0.098722	0.088112	186	0.002841	0.001790
36	0.093750	0.097506	192	0.004261	0.001527
42	0.098722	0.096869	198	0.002841	0.001306
48	0.099432	0.090182	204	0.002841	0.001119
54	0.068182	0.080591	210	0.002131	0.000960
60	0.067472	0.070132	216	0.002131	0.000826
66	0.044034	0.059972	222	0.002131	0.000711
72	0.044744	0.050695	228	0.006392	0.000614
78	0.032670	0.042530	234	0.002841	0.000531
84	0.028409	0.035510	240	0.002841	0.000460
90	0.024148	0.029565	246	0.000000	0.000399
96	0.023438	0.024580	252	0.000000	0.000347
102	0.021307	0.020427	258	0.002841	0.000302
108	0.013494	0.016981	264	0.005682	0.000263
114	0.013494	0.014128	270	0.002841	0.000230
120	0.017756	0.011769	276	0.000710	0.000201
126	0.009233	0.009819	282	0.001420	0.000176
132	0.007102	0.008207	288	0.002841	0.000155
138	0.011364	0.006872	294	0.000000	0.000136
144	0.007813	0.005766	300	0.000000	0.000120
150	0.004972	0.004848			
156	0.006392	0.004084			



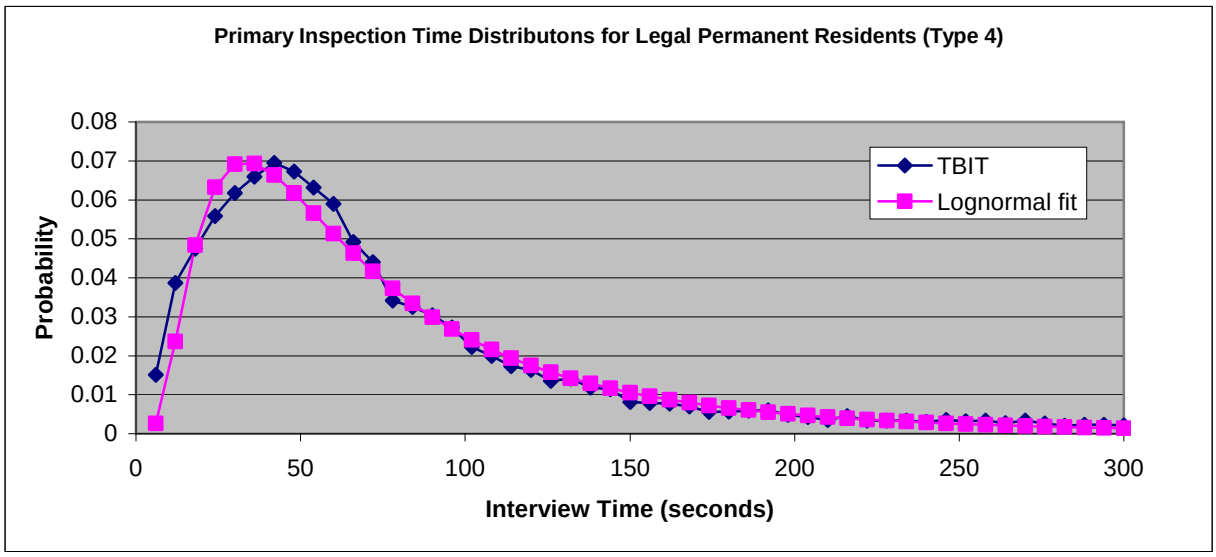
B.3 Canadian citizens without documents

Time (sec)	TBIT Probability	Time (sec)	TBIT Probability
6	0.500000	162	0.000000
12	0.000000	168	0.000000
18	0.000000	174	0.000000
24	0.000000	180	0.000000
30	0.000000	186	0.000000
36	0.000000	192	0.000000
42	0.000000	198	0.000000
48	0.000000	204	0.000000
54	0.000000	210	0.000000
60	0.000000	216	0.000000
66	0.500000	222	0.000000
72	0.000000	228	0.000000
78	0.000000	234	0.000000
84	0.000000	240	0.000000
90	0.000000	246	0.000000
96	0.000000	252	0.000000
102	0.000000	258	0.000000
108	0.000000	264	0.000000
114	0.000000	270	0.000000
120	0.000000	276	0.000000
126	0.000000	282	0.000000
132	0.000000	288	0.000000
138	0.000000	294	0.000000
144	0.000000	300	0.000000
150	0.000000		
156	0.000000		



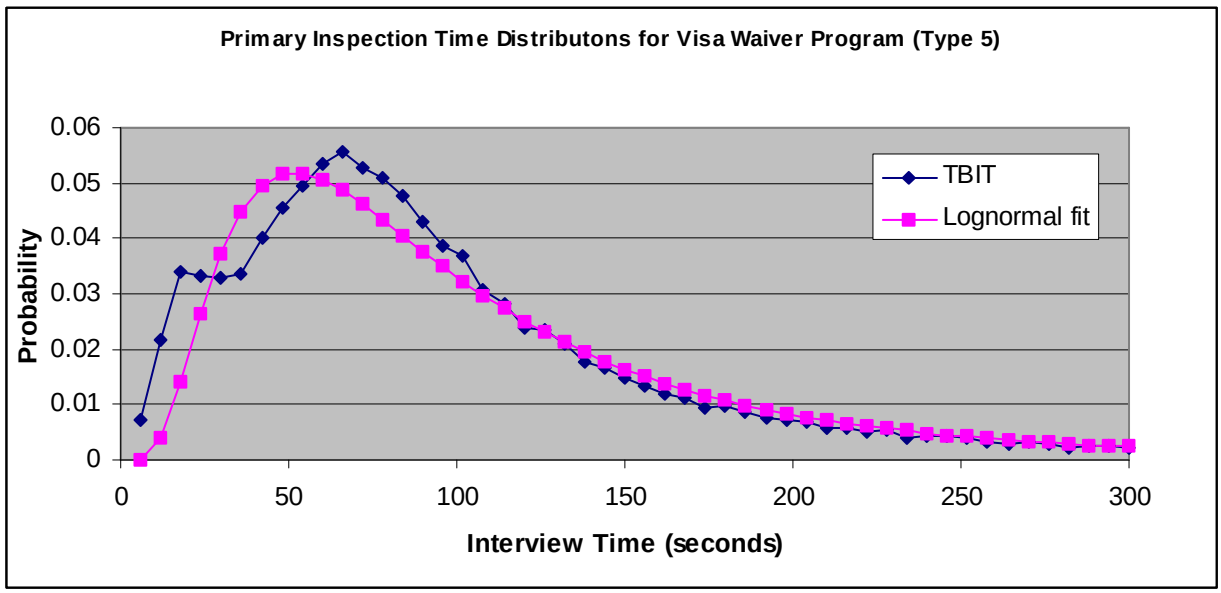
B.4 Legal Permanent Residents (LPR)

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.015119	0.002665	162	0.007690	0.008715
12	0.038709	0.023637	168	0.006951	0.007936
18	0.047441	0.048352	174	0.005604	0.007238
24	0.055869	0.063216	180	0.005691	0.006609
30	0.061778	0.069130	186	0.005908	0.006044
36	0.065948	0.069335	192	0.005995	0.005534
42	0.069511	0.066357	198	0.004822	0.005073
48	0.067295	0.061805	204	0.004301	0.004657
54	0.063168	0.056631	210	0.003519	0.004280
60	0.058997	0.051373	216	0.004518	0.003938
66	0.049179	0.046317	222	0.003345	0.003627
72	0.044009	0.041608	228	0.003389	0.003345
78	0.034191	0.037305	234	0.003345	0.003088
84	0.032540	0.033418	240	0.003041	0.002854
90	0.030411	0.029933	246	0.003519	0.002640
96	0.027283	0.026824	252	0.003215	0.002445
102	0.022287	0.024057	258	0.003389	0.002266
108	0.019941	0.021598	264	0.002737	0.002102
114	0.017334	0.019414	270	0.003389	0.001952
120	0.016378	0.017475	276	0.002607	0.001815
126	0.013555	0.015752	282	0.002042	0.001688
132	0.014119	0.014219	288	0.002259	0.001572
138	0.011817	0.012855	294	0.002303	0.001465
144	0.011382	0.011638	300	0.002172	0.001366
150	0.008124	0.010553			
156	0.007863	0.009583			



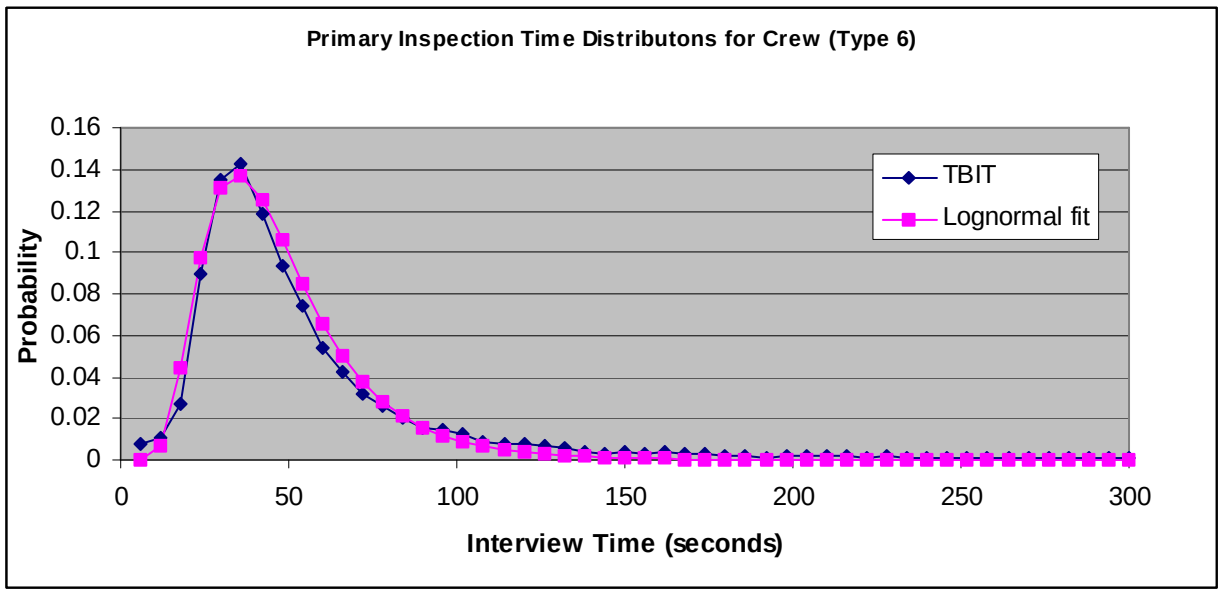
B.5 Visa Waiver Program (VWP)

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.007127	0.000155	162	0.011954	0.013807
12	0.021648	0.003829	168	0.011341	0.012692
18	0.033851	0.014069	174	0.009464	0.011673
24	0.033200	0.026507	180	0.009789	0.010743
30	0.032989	0.037227	186	0.008736	0.009892
36	0.033717	0.044859	192	0.007510	0.009116
42	0.040116	0.049443	198	0.007069	0.008405
48	0.045441	0.051529	204	0.006897	0.007756
54	0.049484	0.051751	210	0.005920	0.007162
60	0.053449	0.050670	216	0.005747	0.006618
66	0.055652	0.048730	222	0.005192	0.006119
72	0.052951	0.046261	228	0.005422	0.005663
78	0.050959	0.043505	234	0.004100	0.005244
84	0.047702	0.040630	240	0.004234	0.004859
90	0.043123	0.037749	246	0.004291	0.004506
96	0.038813	0.034938	252	0.003946	0.004182
102	0.036955	0.032246	258	0.003142	0.003883
108	0.030882	0.029701	264	0.002893	0.003608
114	0.028296	0.027317	270	0.003295	0.003355
120	0.023985	0.025099	276	0.002778	0.003122
126	0.023372	0.023047	282	0.002337	0.002907
132	0.020824	0.021156	288	0.002701	0.002709
138	0.017587	0.019417	294	0.002433	0.002526
144	0.016552	0.017823	300	0.002050	0.002356
150	0.014847	0.016363			
156	0.013238	0.015028			



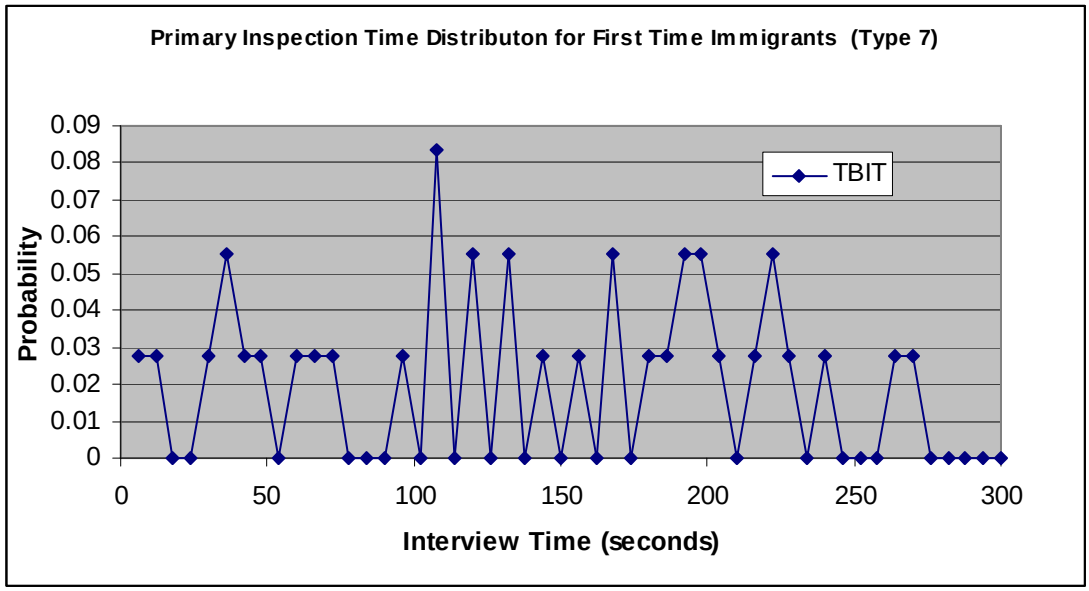
B.6 Crew

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.007828	0.000053	162	0.003914	0.000555
12	0.010130	0.006926	168	0.002935	0.000430
18	0.026591	0.044818	174	0.002648	0.000334
24	0.090077	0.097771	180	0.001727	0.000261
30	0.135087	0.131011	186	0.002302	0.000204
36	0.142742	0.137195	192	0.001381	0.000161
42	0.118568	0.125317	198	0.002130	0.000127
48	0.093243	0.105603	204	0.001784	0.000100
54	0.074019	0.084698	210	0.001612	0.000080
60	0.053931	0.065863	216	0.001554	0.000063
66	0.042132	0.050231	222	0.001094	0.000051
72	0.032175	0.037853	228	0.001496	0.000041
78	0.025728	0.028325	234	0.001266	0.000033
84	0.020318	0.021119	240	0.000921	0.000026
90	0.014965	0.015724	246	0.001209	0.000021
96	0.014217	0.011712	252	0.001266	0.000017
102	0.012720	0.008735	258	0.000633	0.000014
108	0.008806	0.006530	264	0.000921	0.000011
114	0.007482	0.004895	270	0.000806	0.000009
120	0.007540	0.003681	276	0.000748	0.000008
126	0.006677	0.002778	282	0.000633	0.000006
132	0.005410	0.002104	288	0.000863	0.000005
138	0.004144	0.001600	294	0.001094	0.000004
144	0.003338	0.001221	300	0.000576	0.000003
150	0.003511	0.000935			
156	0.003108	0.000719			



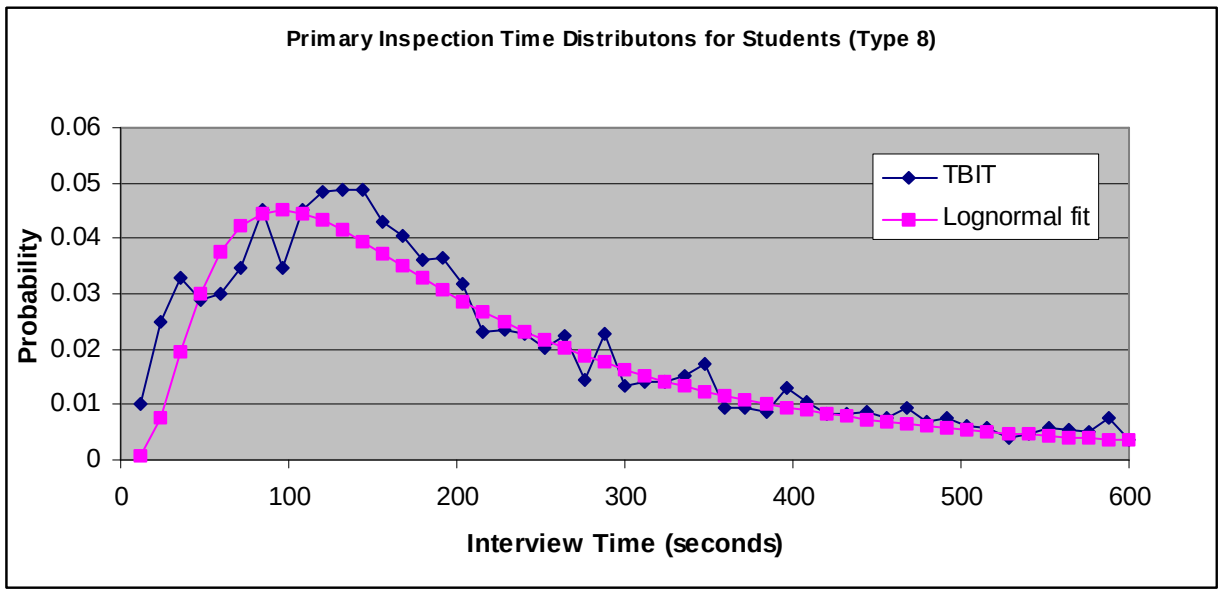
B.7 First-time immigrants

Time (sec)	TBIT Probability	Time (sec)	TBIT Probability
6	0.027778	162	0.000000
12	0.027778	168	0.055556
18	0.000000	174	0.000000
24	0.000000	180	0.027778
30	0.027778	186	0.027778
36	0.055556	192	0.055556
42	0.027778	198	0.055556
48	0.027778	204	0.027778
54	0.000000	210	0.000000
60	0.027778	216	0.027778
66	0.027778	222	0.055556
72	0.027778	228	0.027778
78	0.000000	234	0.000000
84	0.000000	240	0.027778
90	0.000000	246	0.000000
96	0.027778	252	0.000000
102	0.000000	258	0.000000
108	0.083333	264	0.027778
114	0.000000	270	0.027778
120	0.055556	276	0.000000
126	0.000000	282	0.000000
132	0.055556	288	0.000000
138	0.000000	294	0.000000
144	0.027778	300	0.000000
150	0.000000		
156	0.027778		



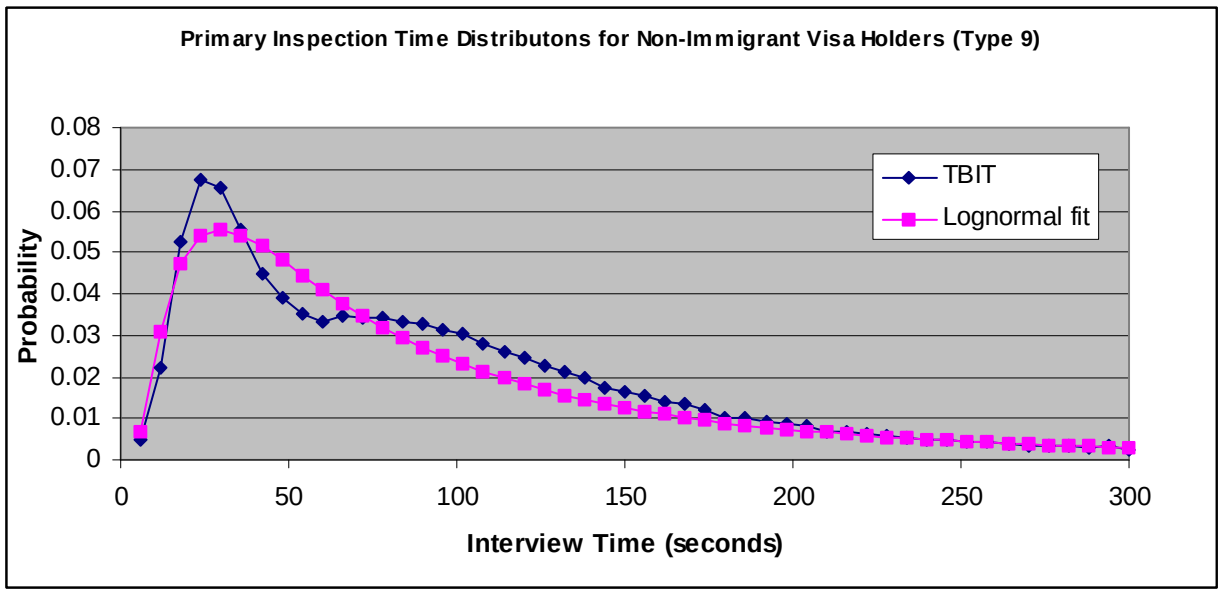
B.8 Students

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
12	0.009942	0.000614	324	0.014085	0.014244
24	0.024855	0.007493	336	0.015327	0.013304
36	0.032726	0.019349	348	0.017399	0.012433
48	0.028998	0.030077	360	0.009528	0.011627
60	0.029826	0.037701	372	0.009528	0.010879
72	0.034797	0.042327	384	0.008699	0.010186
84	0.045153	0.044602	396	0.012842	0.009543
96	0.034797	0.045188	408	0.010356	0.008947
108	0.045153	0.044620	420	0.008285	0.008393
120	0.048467	0.043298	432	0.008285	0.007878
132	0.048882	0.041508	444	0.008699	0.007400
144	0.048882	0.039452	456	0.007457	0.006955
156	0.043082	0.037267	468	0.009528	0.006541
168	0.040597	0.035048	480	0.007042	0.006156
180	0.036040	0.032855	492	0.007457	0.005797
192	0.036454	0.030730	504	0.006214	0.005462
204	0.031897	0.028696	516	0.005800	0.005149
216	0.023198	0.026768	528	0.004143	0.004858
228	0.023612	0.024953	540	0.004557	0.004585
240	0.022784	0.023252	552	0.005800	0.004330
252	0.020298	0.021664	564	0.005385	0.004092
264	0.022370	0.020186	576	0.004971	0.003869
276	0.014499	0.018812	588	0.007457	0.003660
288	0.022784	0.017537	600	0.003728	0.003464
300	0.013256	0.016355			
312	0.014085	0.015259			



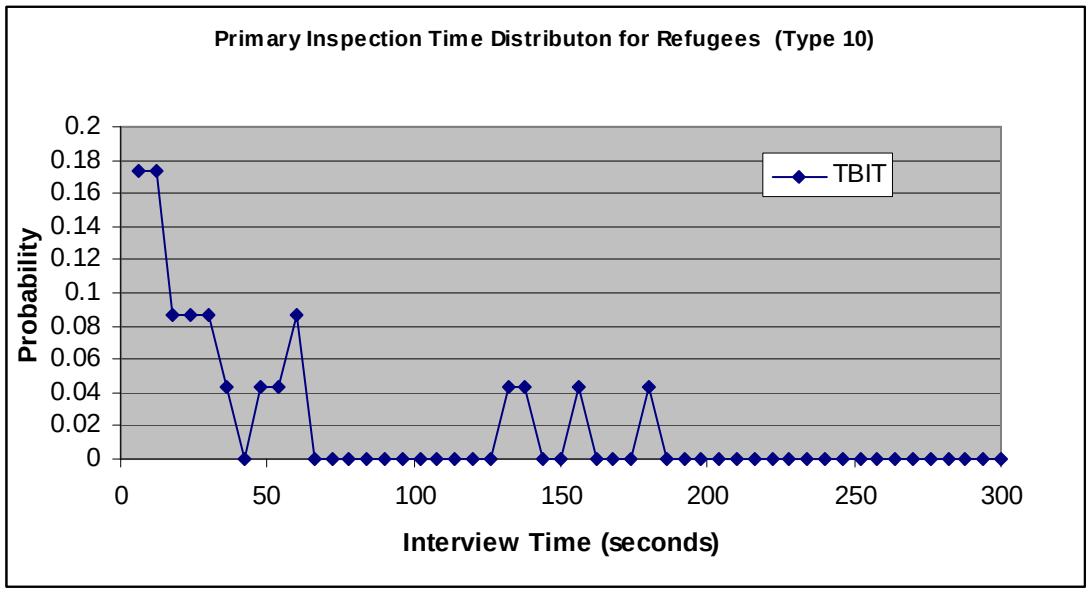
B.9 Non-immigrant visa holders

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
6	0.004740	0.006620	162	0.013896	0.010889
12	0.022300	0.030730	168	0.013611	0.010175
18	0.052383	0.047096	174	0.011901	0.009519
24	0.067445	0.053998	180	0.010088	0.008915
30	0.065748	0.055458	186	0.009959	0.008358
36	0.055181	0.054095	192	0.008923	0.007844
42	0.045041	0.051360	198	0.008573	0.007368
48	0.038967	0.048036	204	0.008249	0.006929
54	0.035160	0.044543	210	0.006980	0.006521
60	0.033114	0.041104	216	0.006747	0.006143
66	0.034797	0.037831	222	0.006371	0.005792
72	0.034020	0.034778	228	0.005996	0.005465
78	0.034033	0.031961	234	0.005284	0.005162
84	0.033165	0.029380	240	0.004740	0.004879
90	0.032919	0.027027	246	0.005038	0.004615
96	0.031339	0.024885	252	0.004364	0.004368
102	0.030290	0.022938	258	0.004183	0.004138
108	0.028167	0.021169	264	0.003833	0.003923
114	0.026159	0.019561	270	0.003613	0.003721
120	0.024566	0.018099	276	0.003471	0.003532
126	0.022546	0.016768	282	0.003250	0.003355
132	0.021186	0.015555	288	0.003004	0.003189
138	0.019529	0.014448	294	0.003367	0.003033
144	0.017547	0.013437	300	0.002486	0.002887
150	0.016304	0.012512			
156	0.015424	0.011665			



B.10 Refugees

Time (sec)	TBIT Probability	Time (sec)	TBIT Probability
6	0.173913	162	0.000000
12	0.173913	168	0.000000
18	0.086957	174	0.000000
24	0.086957	180	0.043478
30	0.086957	186	0.000000
36	0.043478	192	0.000000
42	0.000000	198	0.000000
48	0.043478	204	0.000000
54	0.043478	210	0.000000
60	0.086957	216	0.000000
66	0.000000	222	0.000000
72	0.000000	228	0.000000
78	0.000000	234	0.000000
84	0.000000	240	0.000000
90	0.000000	246	0.000000
96	0.000000	252	0.000000
102	0.000000	258	0.000000
108	0.000000	264	0.000000
114	0.000000	270	0.000000
120	0.000000	276	0.000000
126	0.000000	282	0.000000
132	0.043478	288	0.000000
138	0.043478	294	0.000000
144	0.000000	300	0.000000
150	0.000000		
156	0.043478		

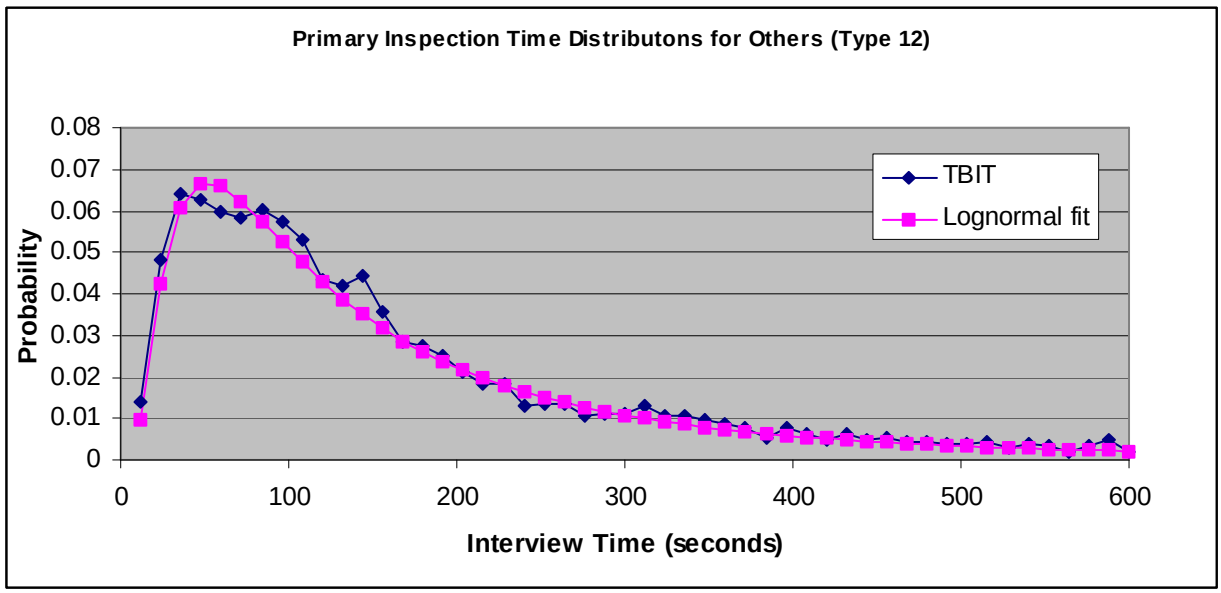


B.11 On secondary or lookout list

Passenger type 11 is not used in this analysis

Time (sec)	TBIT Probability	Lognormal Probability	Time (sec)	TBIT Probability	Lognormal Probability
12	0.014071	0.009810	324	0.010794	0.009183
24	0.048381	0.042273	336	0.010794	0.008509
36	0.064187	0.060960	348	0.009638	0.007895
48	0.062645	0.066679	360	0.008674	0.007335
60	0.059753	0.065903	372	0.007710	0.006823
72	0.058404	0.062227	384	0.005397	0.006355
84	0.060139	0.057432	396	0.007517	0.005926
96	0.057247	0.052381	408	0.006361	0.005532
108	0.053007	0.047484	420	0.004819	0.005171
120	0.043562	0.042922	432	0.006168	0.004838
132	0.041827	0.038761	444	0.005012	0.004531
144	0.044140	0.035010	456	0.005397	0.004248
156	0.035852	0.031649	468	0.004241	0.003986
168	0.028527	0.028649	480	0.004241	0.003744
180	0.027564	0.025974	492	0.004048	0.003520
192	0.024865	0.023589	504	0.004048	0.003312
204	0.021203	0.021462	516	0.004241	0.003119
216	0.018311	0.019563	528	0.003084	0.002940
228	0.018119	0.017864	540	0.003662	0.002773
240	0.013107	0.016342	552	0.003470	0.002618
252	0.013685	0.014976	564	0.002120	0.002473
264	0.013685	0.013749	576	0.003277	0.002338
276	0.010601	0.012643	588	0.005012	0.002212
288	0.011180	0.011645	600	0.002120	0.002094
300	0.010987	0.010742			
312	0.013107	0.009925			

B.12 Other


Primary Inspection Time Distributons for Others (Type 12)
Probability
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
100
200
300
400
500
600
Interview Time (seconds)
TBIT
Lognormal fit

Appendix C Views of Simulation Model

Figure C-1 - Traveler generation and characterization

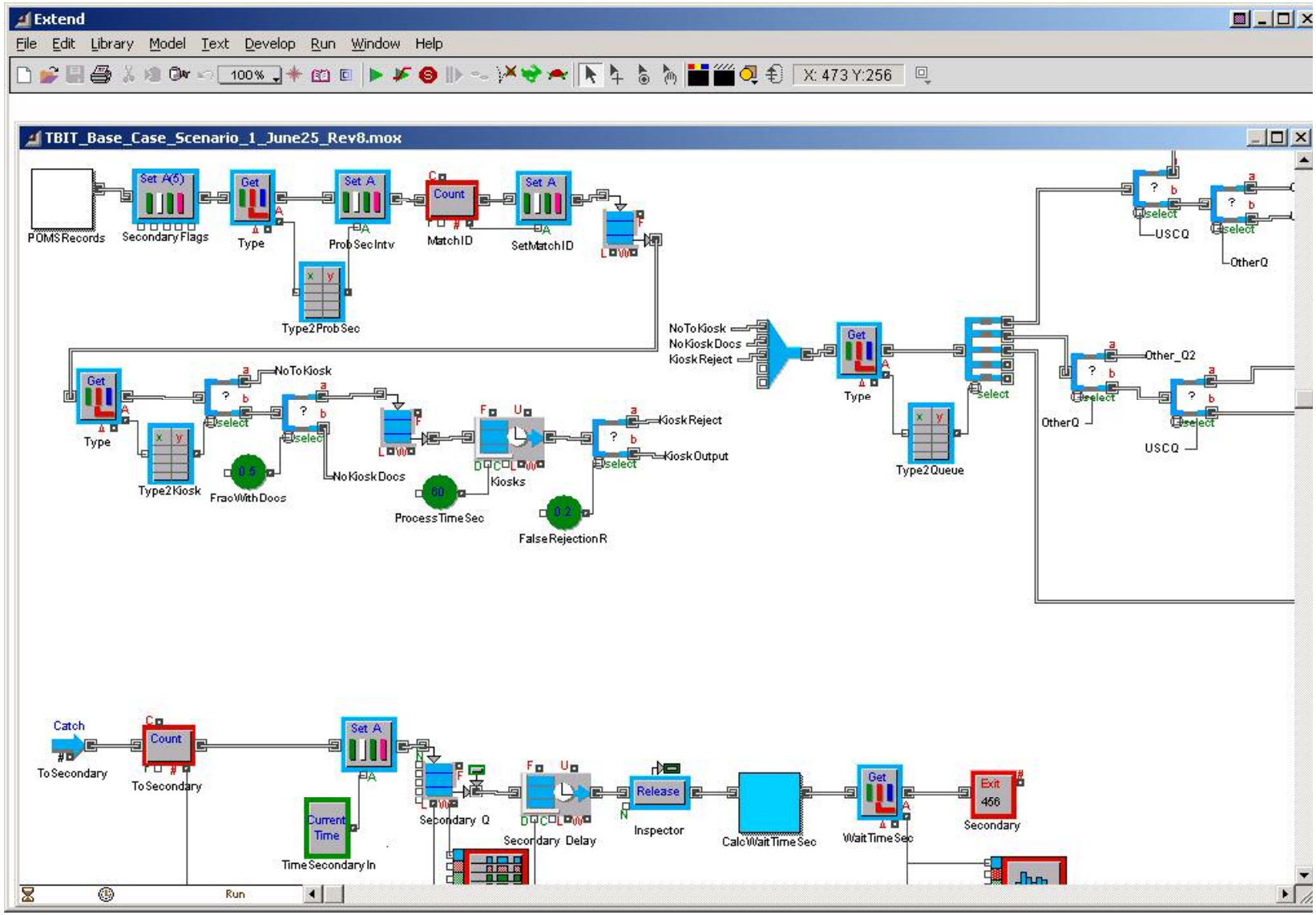


Figure C-2 - Details of traveler generation and inspection time sampling

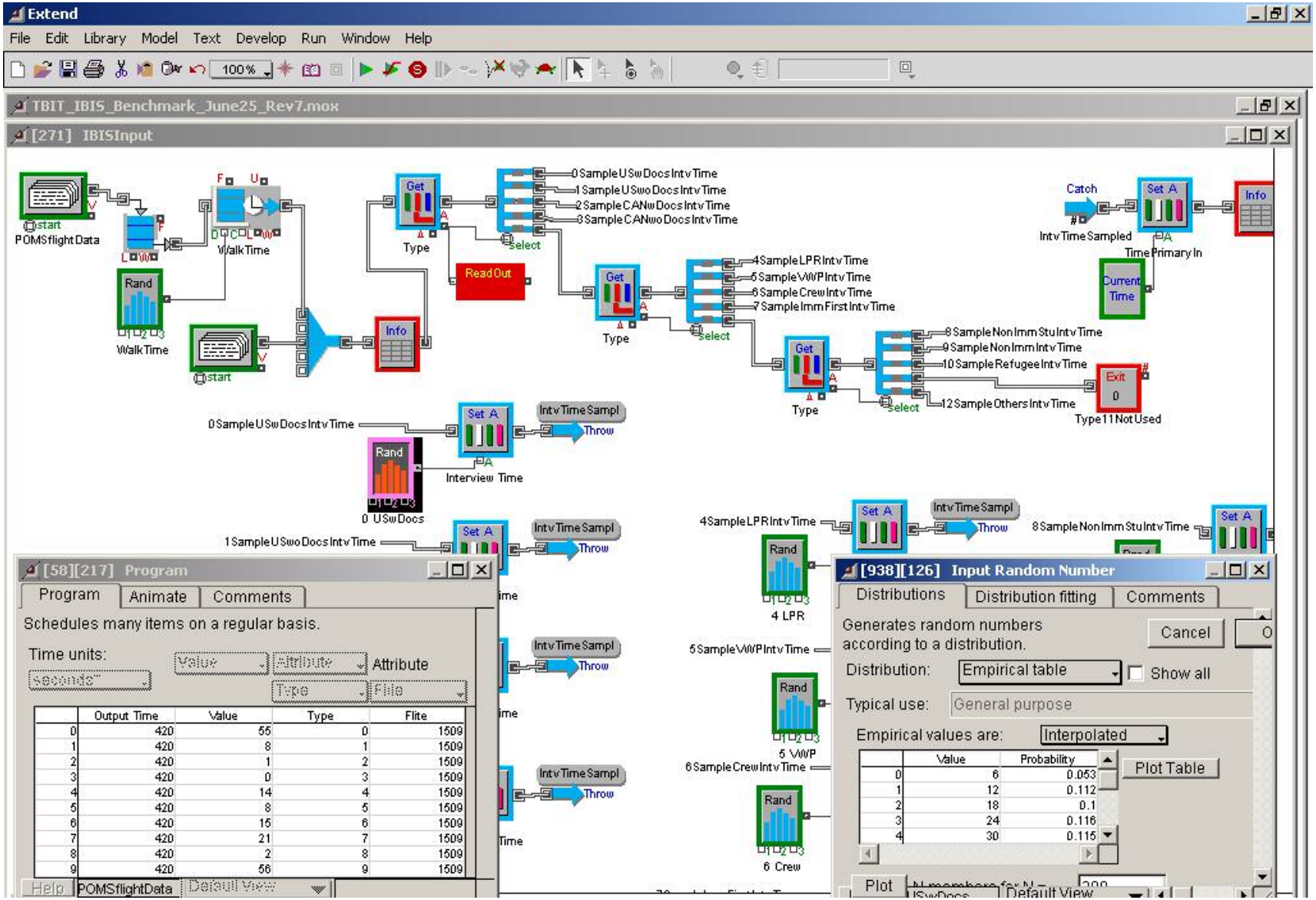


Figure C-3 - Traveler routing logic

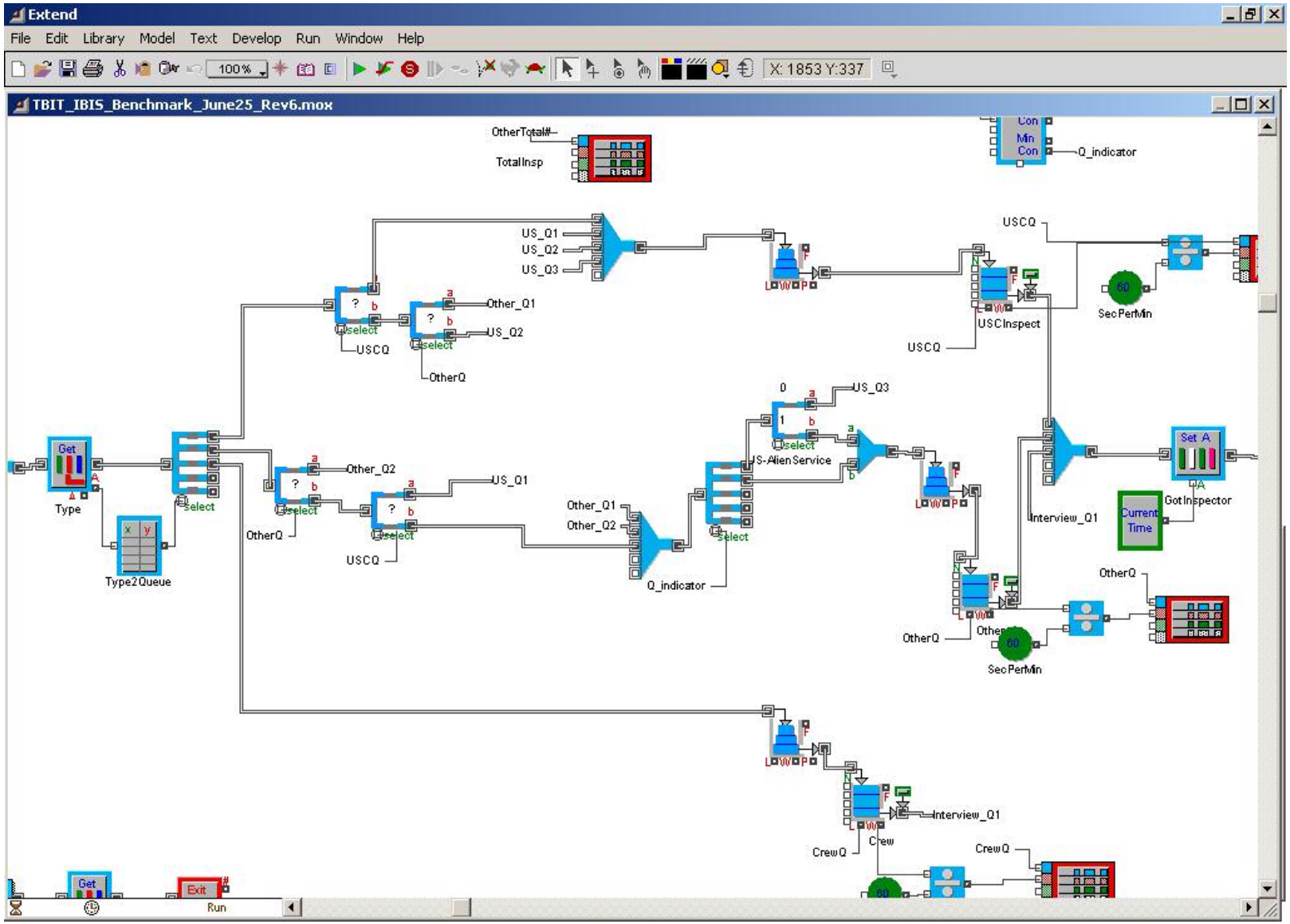


Figure C-4 - Process routing by traveler type

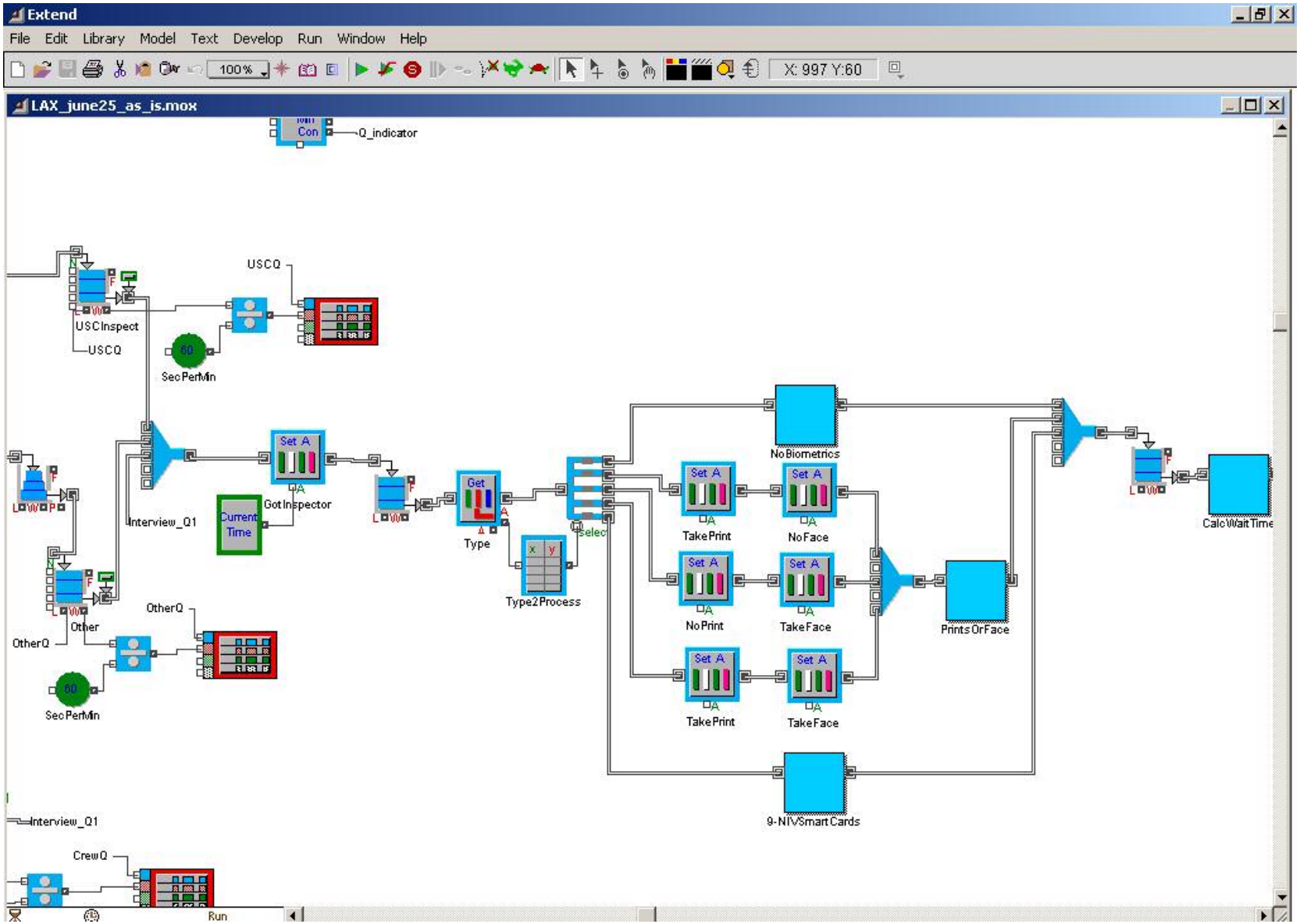


Figure C-5 - Details of prints and face processes – acquire biometrics in primary

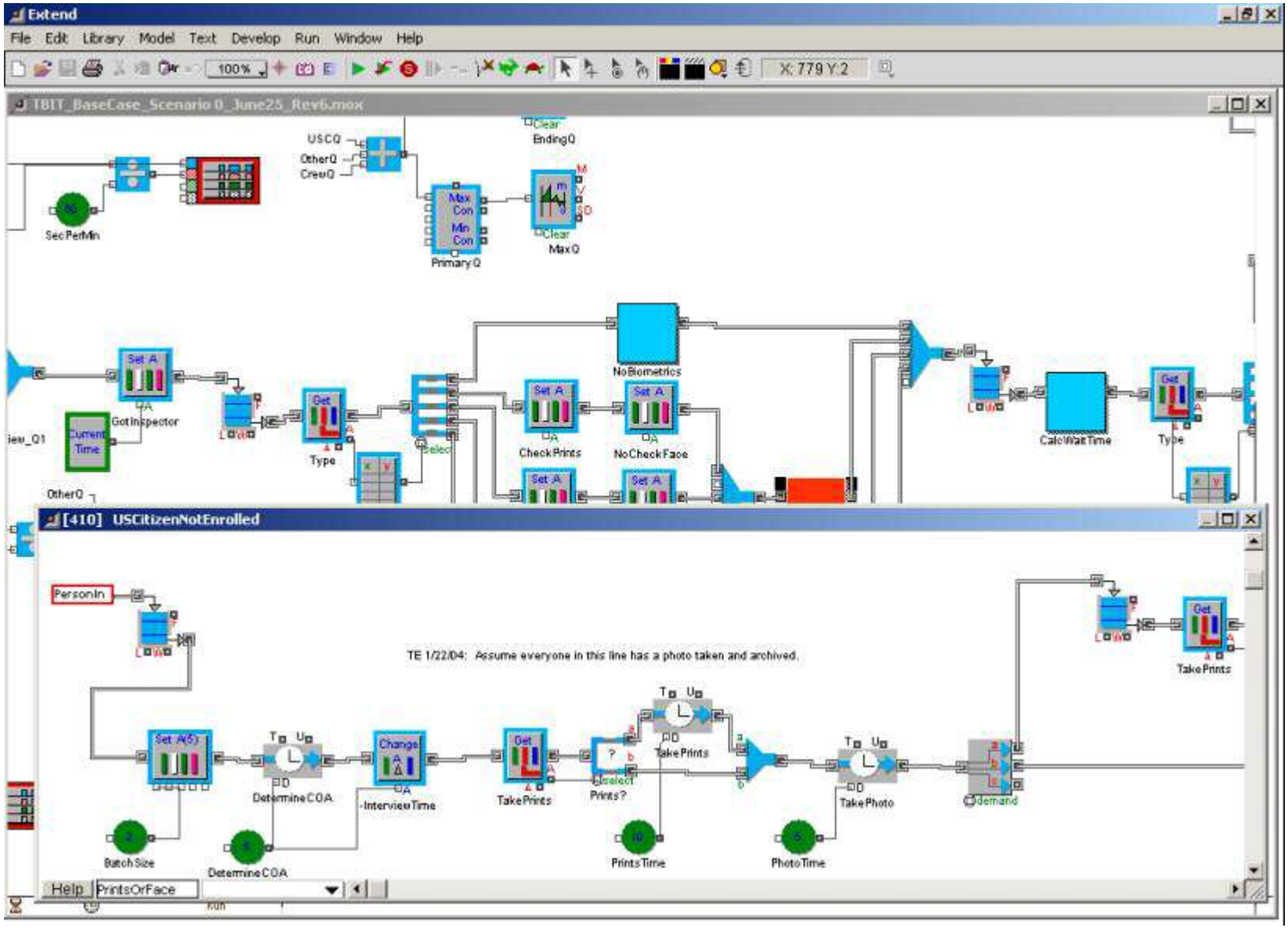


Figure C-6 - Details of prints and face processes – interview and check biometrics in parallel

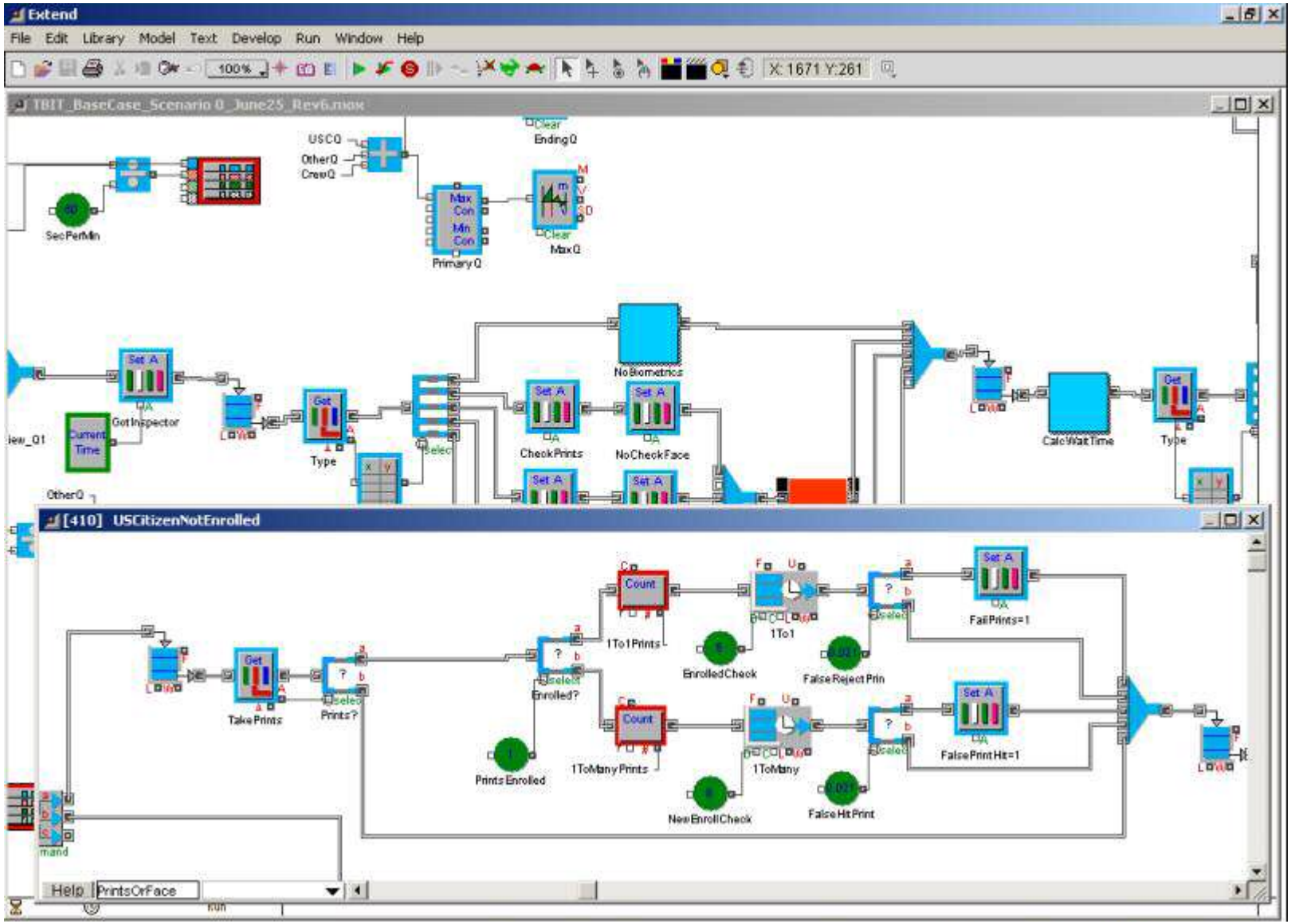
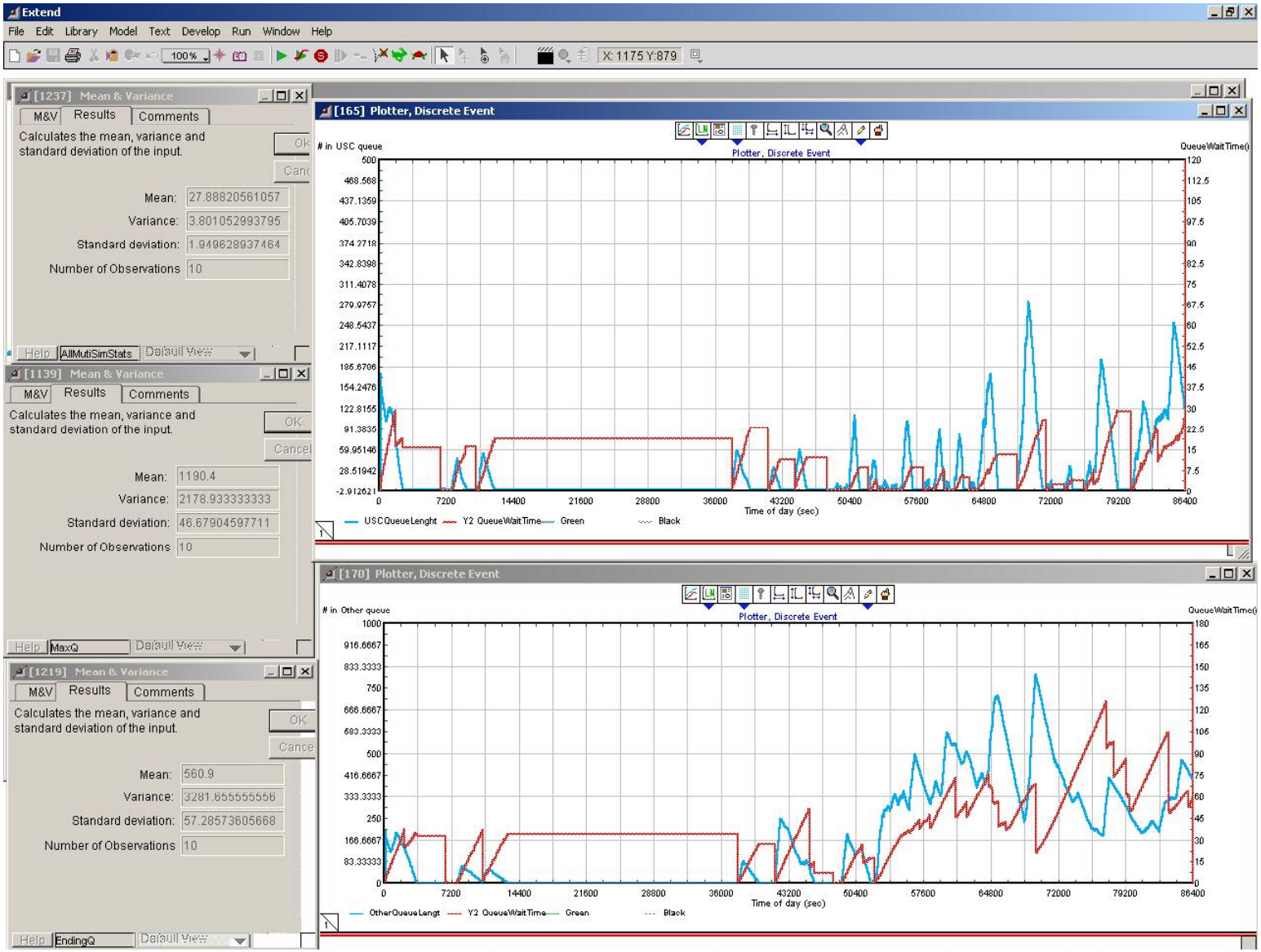


Figure C-7 - Output of Simulation Model



Appendix D Traveler Arrival Data File

Time (sec)	Number of Travelers	Traveler Type	Flight index
420	55	0	1509
420	8	1	1509
420	1	2	1509
420	0	3	1509
420	14	4	1509
420	8	5	1509
420	15	6	1509
420	21	7	1509
420	2	8	1509
420	56	9	1509
420	0	10	1509
420	4	12	1509
720	18	0	1531
720	3	1	1531
720	0	2	1531
720	0	3	1531
720	4	4	1531
720	2	5	1531
720	6	6	1531
720	8	7	1531
720	0	8	1531
720	13	9	1531
720	0	10	1531
720	1	12	1531
6300	6	0	1499
6300	1	1	1499
6300	0	2	1499
6300	0	3	1499
6300	2	4	1499
6300	0	5	1499
6300	6	6	1499
6300	16	7	1499
6300	1	8	1499
6300	17	9	1499
6300	0	10	1499
6300	1	12	1499
6300	18	0	1537
6300	3	1	1537
6300	0	2	1537
6300	0	3	1537
6300	5	4	1537
6300	1	5	1537
6300	6	6	1537
6300	14	7	1537
6300	0	8	1537
6300	6	9	1537
6300	0	10	1537
6300	1	12	1537
7500	55	0	1546
7500	8	1	1546

7500	1	2	1546
7500	0	3	1546
7500	15	4	1546
7500	0	5	1546
7500	6	6	1546
7500	15	7	1546
7500	2	8	1546
7500	47	9	1546
7500	0	10	1546
7500	3	12	1546
10080	4	0	1513
10080	1	1	1513
10080	0	2	1513
10080	0	3	1513
10080	0	4	1513
10080	3	5	1513
10080	6	6	1513
10080	8	7	1513
10080	1	8	1513
10080	30	9	1513
10080	0	10	1513
10080	2	12	1513
10320	67	0	1527
10320	10	1	1527
10320	1	2	1527
10320	0	3	1527
10320	18	4	1527
10320	0	5	1527
10320	7	6	1527
10320	7	7	1527
10320	0	8	1527
10320	3	9	1527
10320	0	10	1527
10320	0	12	1527
37500	79	0	1523
37500	11	1	1523
37500	1	2	1523
37500	0	3	1523
37500	21	4	1523
37500	24	5	1523
37500	14	6	1523
37500	0	7	1523
37500	2	8	1523
37500	69	9	1523
37500	0	10	1523
37500	5	12	1523
41460	50	0	1520
41460	7	1	1520
41460	1	2	1520
41460	0	3	1520
41460	14	4	1520
41460	211	5	1520
41460	18	6	1520
41460	0	7	1520
41460	2	8	1520

41460	53	9	1520
41460	0	10	1520
41460	3	12	1520
44220	85	0	1550
44220	12	1	1550
44220	1	2	1550
44220	0	3	1550
44220	23	4	1550
44220	39	5	1550
44220	0	6	1550
44220	0	7	1550
44220	0	8	1550
44220	4	9	1550
44220	0	10	1550
44220	0	12	1550
44700	1	0	1535
44700	0	1	1535
44700	0	2	1535
44700	0	3	1535
44700	1	4	1535
44700	0	5	1535
44700	6	6	1535
44700	0	7	1535
44700	0	8	1535
44700	4	9	1535
44700	0	10	1535
44700	0	12	1535
47700	42	0	1538
47700	6	1	1538
47700	0	2	1538
47700	0	3	1538
47700	12	4	1538
47700	11	5	1538
47700	6	6	1538
47700	0	7	1538
47700	1	8	1538
47700	25	9	1538
47700	0	10	1538
47700	2	12	1538
48300	21	0	1532
48300	3	1	1532
48300	0	2	1532
48300	0	3	1532
48300	6	4	1532
48300	6	5	1532
48300	6	6	1532
48300	0	7	1532
48300	2	8	1532
48300	49	9	1532
48300	0	10	1532
48300	3	12	1532
48600	61	0	1522
48600	9	1	1522
48600	1	2	1522
48600	0	3	1522

48600	16	4	1522
48600	16	5	1522
48600	26	6	1522
48600	0	7	1522
48600	6	8	1522
48600	183	9	1522
48600	0	10	1522
48600	12	12	1522
49500	43	0	1518
49500	6	1	1518
49500	0	2	1518
49500	0	3	1518
49500	13	4	1518
49500	2	5	1518
49500	5	6	1518
49500	0	7	1518
49500	1	8	1518
49500	31	9	1518
49500	0	10	1518
49500	2	12	1518
50040	17	0	1548
50040	2	1	1548
50040	0	2	1548
50040	0	3	1548
50040	5	4	1548
50040	1	5	1548
50040	6	6	1548
50040	0	7	1548
50040	1	8	1548
50040	43	9	1548
50040	0	10	1548
50040	3	12	1548
50100	187	0	1551
50100	27	1	1551
50100	2	2	1551
50100	0	3	1551
50100	50	4	1551
50100	5	5	1551
50100	12	6	1551
50100	0	7	1551
50100	0	8	1551
50100	0	9	1551
50100	0	10	1551
50100	0	12	1551
52080	99	0	1549
52080	14	1	1549
52080	1	2	1549
52080	0	3	1549
52080	27	4	1549
52080	19	5	1549
52080	21	6	1549
52080	0	7	1549
52080	4	8	1549
52080	129	9	1549
52080	0	10	1549

52080	9	12	1549
52380	75	0	1516
52380	11	1	1516
52380	1	2	1516
52380	0	3	1516
52380	20	4	1516
52380	137	5	1516
52380	21	6	1516
52380	0	7	1516
52380	1	8	1516
52380	44	9	1516
52380	0	10	1516
52380	3	12	1516
53040	34	0	1540
53040	5	1	1540
53040	0	2	1540
53040	0	3	1540
53040	9	4	1540
53040	104	5	1540
53040	14	6	1540
53040	0	7	1540
53040	1	8	1540
53040	35	9	1540
53040	0	10	1540
53040	2	12	1540
53700	88	0	1541
53700	13	1	1541
53700	1	2	1541
53700	0	3	1541
53700	24	4	1541
53700	1	5	1541
53700	14	6	1541
53700	0	7	1541
53700	4	8	1541
53700	119	9	1541
53700	0	10	1541
53700	8	12	1541
54600	79	0	1515
54600	11	1	1515
54600	1	2	1515
54600	0	3	1515
54600	21	4	1515
54600	91	5	1515
54600	0	6	1515
54600	17	7	1515
54600	1	8	1515
54600	26	9	1515
54600	0	10	1515
54600	2	12	1515
55440	37	0	1519
55440	5	1	1519
55440	0	2	1519
55440	0	3	1519
55440	11	4	1519
55440	2	5	1519

55440	5	6	1519
55440	0	7	1519
55440	1	8	1519
55440	31	9	1519
55440	0	10	1519
55440	2	12	1519
55620	59	0	1530
55620	9	1	1530
55620	1	2	1530
55620	0	3	1530
55620	15	4	1530
55620	1	5	1530
55620	26	6	1530
55620	0	7	1530
55620	1	8	1530
55620	34	9	1530
55620	0	10	1530
55620	2	12	1530
55800	138	0	1526
55800	20	1	1526
55800	2	2	1526
55800	0	3	1526
55800	37	4	1526
55800	113	5	1526
55800	20	6	1526
55800	0	7	1526
55800	2	8	1526
55800	69	9	1526
55800	0	10	1526
55800	5	12	1526
58020	112	0	1529
58020	16	1	1529
58020	1	2	1529
58020	0	3	1529
58020	31	4	1529
58020	3	5	1529
58020	17	6	1529
58020	0	7	1529
58020	4	8	1529
58020	120	9	1529
58020	0	10	1529
58020	8	12	1529
59160	83	0	1528
59160	12	1	1528
59160	1	2	1528
59160	0	3	1528
59160	23	4	1528
59160	62	5	1528
59160	13	6	1528
59160	0	7	1528
59160	1	8	1528
59160	19	9	1528
59160	0	10	1528
59160	1	12	1528
59220	108	0	1544

59220	16	1	1544
59220	1	2	1544
59220	0	3	1544
59220	29	4	1544
59220	135	5	1544
59220	22	6	1544
59220	0	7	1544
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59220	53	9	1544
59220	0	10	1544
59220	3	12	1544
60300	105	0	1543
60300	15	1	1543
60300	1	2	1543
60300	0	3	1543
60300	29	4	1543
60300	26	5	1543
60300	16	6	1543
60300	0	7	1543
60300	0	8	1543
60300	14	9	1543
60300	0	10	1543
60300	1	12	1543
61320	108	0	1511
61320	16	1	1511
61320	1	2	1511
61320	0	3	1511
61320	29	4	1511
61320	4	5	1511
61320	22	6	1511
61320	0	7	1511
61320	2	8	1511
61320	71	9	1511
61320	0	10	1511
61320	5	12	1511
61500	82	0	1501
61500	12	1	1501
61500	1	2	1501
61500	0	3	1501
61500	22	4	1501
61500	0	5	1501
61500	5	6	1501
61500	0	7	1501
61500	0	8	1501
61500	0	9	1501
61500	0	10	1501
61500	0	12	1501
63000	89	0	1497
63000	13	1	1497
63000	1	2	1497
63000	0	3	1497
63000	24	4	1497
63000	80	5	1497
63000	16	6	1497
63000	0	7	1497

63000	2	8	1497
63000	49	9	1497
63000	0	10	1497
63000	3	12	1497
63900	104	0	1525
63900	15	1	1525
63900	1	2	1525
63900	0	3	1525
63900	28	4	1525
63900	53	5	1525
63900	14	6	1525
63900	0	7	1525
63900	1	8	1525
63900	40	9	1525
63900	0	10	1525
63900	3	12	1525
63900	55	0	1536
63900	8	1	1536
63900	1	2	1536
63900	0	3	1536
63900	14	4	1536
63900	3	5	1536
63900	6	6	1536
63900	0	7	1536
63900	1	8	1536
63900	22	9	1536
63900	0	10	1536
63900	1	12	1536
64260	84	0	1508
64260	12	1	1508
64260	1	2	1508
64260	0	3	1508
64260	23	4	1508
64260	178	5	1508
64260	19	6	1508
64260	0	7	1508
64260	2	8	1508
64260	47	9	1508
64260	0	10	1508
64260	3	12	1508
64680	164	0	1514
64680	24	1	1514
64680	2	2	1514
64680	0	3	1514
64680	44	4	1514
64680	19	5	1514
64680	21	6	1514
64680	0	7	1514
64680	3	8	1514
64680	88	9	1514
64680	0	10	1514
64680	6	12	1514
68100	62	0	1498
68100	9	1	1498
68100	1	2	1498

68100	0	3	1498
68100	16	4	1498
68100	99	5	1498
68100	17	6	1498
68100	0	7	1498
68100	2	8	1498
68100	64	9	1498
68100	0	10	1498
68100	4	12	1498
68100	92	0	1502
68100	13	1	1502
68100	1	2	1502
68100	0	3	1502
68100	25	4	1502
68100	1	5	1502
68100	5	6	1502
68100	0	7	1502
68100	0	8	1502
68100	3	9	1502
68100	0	10	1502
68100	0	12	1502
68340	75	0	1510
68340	11	1	1510
68340	1	2	1510
68340	0	3	1510
68340	20	4	1510
68340	2	5	1510
68340	20	6	1510
68340	0	7	1510
68340	4	8	1510
68340	114	9	1510
68340	0	10	1510
68340	7	12	1510
68700	88	0	1521
68700	13	1	1521
68700	1	2	1521
68700	0	3	1521
68700	24	4	1521
68700	5	5	1521
68700	25	6	1521
68700	0	7	1521
68700	5	8	1521
68700	140	9	1521
68700	0	10	1521
68700	9	12	1521
68700	126	0	1524
68700	18	1	1524
68700	1	2	1524
68700	0	3	1524
68700	34	4	1524
68700	146	5	1524
68700	19	6	1524
68700	0	7	1524
68700	2	8	1524
68700	55	9	1524

68700	0	10	1524
68700	4	12	1524
71160	63	0	1533
71160	9	1	1533
71160	1	2	1533
71160	0	3	1533
71160	17	4	1533
71160	5	5	1533
71160	12	6	1533
71160	0	7	1533
71160	1	8	1533
71160	38	9	1533
71160	0	10	1533
71160	3	12	1533
73200	79	0	1545
73200	12	1	1545
73200	1	2	1545
73200	0	3	1545
73200	21	4	1545
73200	0	5	1545
73200	13	6	1545
73200	0	7	1545
73200	2	8	1545
73200	60	9	1545
73200	0	10	1545
73200	4	12	1545
75300	86	0	1503
75300	13	1	1503
75300	1	2	1503
75300	0	3	1503
75300	23	4	1503
75300	0	5	1503
75300	5	6	1503
75300	0	7	1503
75300	0	8	1503
75300	8	9	1503
75300	0	10	1503
75300	1	12	1503
76200	85	0	1504
76200	12	1	1504
76200	1	2	1504
76200	0	3	1504
76200	23	4	1504
76200	0	5	1504
76200	5	6	1504
76200	0	7	1504
76200	0	8	1504
76200	0	9	1504
76200	0	10	1504
76200	0	12	1504
76500	86	0	1506
76500	12	1	1506
76500	1	2	1506
76500	0	3	1506
76500	23	4	1506

76500	2	5	1506
76500	5	6	1506
76500	0	7	1506
76500	0	8	1506
76500	15	9	1506
76500	0	10	1506
76500	1	12	1506
76560	79	0	1507
76560	12	1	1507
76560	1	2	1507
76560	0	3	1507
76560	21	4	1507
76560	140	5	1507
76560	19	6	1507
76560	0	7	1507
76560	1	8	1507
76560	34	9	1507
76560	0	10	1507
76560	2	12	1507
80280	91	0	1500
80280	13	1	1500
80280	1	2	1500
80280	0	3	1500
80280	25	4	1500
80280	0	5	1500
80280	5	6	1500
80280	0	7	1500
80280	0	8	1500
80280	1	9	1500
80280	0	10	1500
80280	0	12	1500
80700	20	0	1517
80700	3	1	1517
80700	0	2	1517
80700	0	3	1517
80700	5	4	1517
80700	0	5	1517
80700	5	6	1517
80700	0	7	1517
80700	1	8	1517
80700	27	9	1517
80700	0	10	1517
80700	2	12	1517
81000	83	0	1505
81000	12	1	1505
81000	1	2	1505
81000	0	3	1505
81000	23	4	1505
81000	0	5	1505
81000	5	6	1505
81000	0	7	1505
81000	0	8	1505
81000	10	9	1505
81000	0	10	1505
81000	1	12	1505

81240	46	0	1552
81240	7	1	1552
81240	1	2	1552
81240	0	3	1552
81240	12	4	1552
81240	5	5	1552
81240	5	6	1552
81240	0	7	1552
81240	1	8	1552
81240	16	9	1552
81240	0	10	1552
81240	1	12	1552
82500	88	0	1512
82500	13	1	1512
82500	1	2	1512
82500	0	3	1512
82500	24	4	1512
82500	21	5	1512
82500	22	6	1512
82500	0	7	1512
82500	3	8	1512
82500	98	9	1512
82500	0	10	1512
82500	7	12	1512
83100	65	0	1534
83100	9	1	1534
83100	1	2	1534
83100	0	3	1534
83100	17	4	1534
83100	1	5	1534
83100	9	6	1534
83100	0	7	1534
83100	1	8	1534
83100	39	9	1534
83100	0	10	1534
83100	3	12	1534
83700	57	0	1539
83700	8	1	1539
83700	1	2	1539
83700	0	3	1539
83700	15	4	1539
83700	2	5	1539
83700	6	6	1539
83700	0	7	1539
83700	1	8	1539
83700	15	9	1539
83700	0	10	1539
83700	1	12	1539
84300	179	0	1542
84300	26	1	1542
84300	2	2	1542
84300	0	3	1542
84300	48	4	1542
84300	2	5	1542
84300	23	6	1542

84300	0	7	1542
84300	4	8	1542
84300	116	9	1542
84300	0	10	1542
84300	7	12	1542

Appendix E Cross Index Between Visa Codes in IBIS and Traveler Type

Visa Code	Traveler Type	Visa Code	Traveler Type	Visa Code	Traveler Type	Visa Code	Traveler Type
LPR	4	F32	7	TD	8	N1	9
VWP	5	F33	7	TN	8	N2	9
WB	5	F41	7	A1	9	N3	9
WT	5	F42	7	A2	9	N4	9
D1	6	F43	7	A3	9	N5	9
D2	6	FX1	7	B1	9	N6	9
CR1	7	FX3	7	B2	9	N7	9
CR2	7	IMM	7	C1	9	N8	9
DV1	7	IR1	7	C2	9	O1	9
DV2	7	IR2	7	C3	9	O2	9
DV3	7	IR3	7	C4	9	O3	9
E11	7	IR4	7	E1	9	P1	9
E12	7	IR5	7	E2	9	P2	9
E13	7	IW1	7	FSM	9	P3	9
E14	7	IW2	7	G1	9	P4	9
E15	7	NA3	7	G2	9	Q1	9
E21	7	SB1	7	G3	9	Q2	9
E22	7	SE1	7	G4	9	Q3	9
E23	7	SE2	7	G5	9	R1	9
E31	7	SE3	7	H1	9	R2	9
E32	7	SR1	7	H1A	9	T1	9
E34	7	SR2	7	H1B	9	T2	9
E35	7	SR3	7	H1C	9	T3	9
EW3	7	T53	7	H2	9	T4	9
EW4	7	AS	8	H2A	9	U2	9
EW5	7	F1	8	H2B	9	U3	9
F11	7	F2	8	H3	9	U4	9
F12	7	IN	8	H4	9	V2	9
F21	7	J1	8	I	9	V3	9
F22	7	J2	8	IT	9	RE	10
F23	7	K1	8	K3	9	SEC	11
F24	7	K2	8	K4	9		
F25	7	M1	8	L1	9		
F31	7	M2	8	L2	9		

Note: At the time this data was extracted from IBIS, visa codes could include hyphens. However, hyphens are ignored for cross referencing purposes. For example, visa code E-11 matches visa code E11.

Appendix F List of Acronyms and Terms

Alien lane crossover rate – aliens are normally routed to dedicated alien lanes at primary inspection; if queues for U.S. citizen inspections are shorter, the alien crossover rate specifies the fraction of aliens that are allowed to move over to the shorter queues for U.S. citizen lanes

Base Case (As-Is) – configuration of processes and systems prior to implementation of US-VISIT

Block time – time when aircraft 'officially' arrives at its gate – also known as flight arrival time

Confirmation time and date (IBIS) – date and time at which data is entered into IBIS system; this is the approximate time at which primary inspection is completed

COA – Class-of-Admission – admission code assigned by the inspector in IBIS

Flight arrival time - time when aircraft 'officially' arrives at its gate – also known as block time

IBIS – Interagency Border Inspection System

IDENT – the US VISIT automated fingerprint-based biometrics tool

Inspection time – time required to acquire biometrics, interview traveler, receive results of biographic and biometrics checks, and make an admissions decision

LAX – Los Angeles airport

TBIT – Tom Bradley International Terminal at Los Angeles International Airport

LPR – Legal permanent resident of the United States

NIV – non-immigrant visa

POE – port of entry

POMS – Port of Entry Office Management System

Primary inspection – the initial procedure whereby an officer makes a determination as to whether and under what conditions a traveler may enter the U.S.

Primary inspection cycle time - time to deplane and walk to primary queue + queue time + inspection time

Primary queue – location where travelers wait for primary inspection

Primary queue length – number of travelers waiting for primary inspection at a point in time

Queue time – time traveler spends waiting in queue for inspection

Scenario 1-4 – alternative implementation scenarios for US-VISIT and other traveler inspection programs

Secondary inspection – process for further evaluation of travelers who were not readily admissible at primary inspection

Traveler – passenger or crewmember

Traveler types – classification system used in this report for travelers; each of the 13 traveler types can be inspected with a different process, and statistics on each traveler type can be collected

US-VISIT - United States Visitor and Immigrant Status Indicator Technology Program

VWP – Visa Waiver Program, citizens of countries participating in this program do not require visas to enter the United States as visitors for business or pleasure for no more than 90 days

Wait time – the sum of queue time and inspection time

Walk time – time required to walk from the gate to the primary queue

Appendix G Business Rules to Populate Missing Class-of-Admission Fields

The following business rules were used to assign visa-class-of-admission:

a) Identify "USC" records:
   i) For "Doc Country Code" = "US" and "Doc Type" and "Visa Class of Entry" blank, assume US citizens
   ii) For "Doc Type" = "F" (facilitation) but no "Visa Class of Entry," and the "Doc Country Code" = either "US" or blank, assume US citizens without passports
   iii) For "Doc Type" = "M" (military ID or orders), assume US citizens
   iv) For "Doc Type" = "P" and "Doc Country Code" = "US" but no "Visa Class of Entry," assume US citizens with passports
   v) Set "Visa Class of Entry" to "USC"
b) Identify "LPR" records:
   i) For "Doc Type" = "A" or "C" but "Visa Class of Entry" blank, assume LPRs to I-551 (doc type "A") or PRC (doc type "C") cards
   ii) Set "Visa Class of Entry" to "LPR"
c) Identify BCC holder records:
   i) For "Doc Type" = "B" but "Visa Class of Entry" blank, assume Mexican BCC holders who may enter at air POEs in either B-1 or B-2 classifications; assume all entering as B-2.
   ii) Set "Visa Class of Entry" to "B2"
d) Identify Visa Waiver Program records:
   i) For "Doc Type" = "P" and "Doc Country Code" = one of 26 VWP country codes and "Visa Class of Entry" blank, assume Visa Waiver program entrant who may enter in either WT or WB . The VWP country codes include: AD, AU, AT, BE, BN, DK, FI, FR, DE, IS, IE, IT, JP, LI, LU, MC, NL, NZ, NO, PT, SM, SG, SI, ES, SE, CH GB.
   ii) Set "Visa Class of Entry" to "WT"
e) Identify Canadian nonimmigrant records:
   i) For "Doc Type" = "P" and "Doc Country Code" = "CA" but "Visa Class of Entry" blank, assume B-2
   ii) Set "Visa Class of Entry" to "B2"
f) Identify Mexican nonimmigrant records:
   i) For "Doc Type" = "P" or "V" and "Doc Country Code" = "MX" but "Visa Class of Entry" blank, assume B-2.
   ii) Set "Visa Class of Entry" to "B2"